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# Merger Makes Improvements Possible

## Chemical Lime Co., Bellefonte, Penn., Makes Numerous Changes Over Past Two Years

THE OPERATIONS of the Chemical Lime Co., Inc., Bellefonte, Penn., were described briefly in ROCK PRODUCTS, August 6, 1927. However, since that time, and particularly during the past two years, quite a number of changes and improvements have been made.

In April, 1930, the old Chemical Lime Co. and the Center County Lime Co. were merged to form the present company. During the early part of that year a new motor-driven drum hoist of the most modern type was installed to handle the cars on the incline at the crushing plant and also a new motor-driven air compressor was put into service. In December of the same year two large concrete silos for the storage of quicklime and hydrate were erected at the hydrating plant.

Also numerous changes have been made in the motors and drives, using speed reducers wherever possible, and push button control throughout. All motor starters are now located in one room, automatic compensators being used on the large motors and across-the-line magnetic contactors on the smaller high-starting torque motors. A General Electric capacitor is used to correct the power factor. These changes were all at the No. 1 plant.

At the No. 2 plant (formerly Center County Lime Co.) the pulverized limestone plant was largely rebuilt during the first part of 1931 and the former wooden trestle at the kilns was replaced with one of steel.

Crushed stone, lime and pulverized limestone are produced. The crushed stone operation at the No. 1 plant has a capacity of 1500 to 2000 tons per 10-hr. day. The lime operation, consisting of 10 shaft kilns and a hydrating plant at the No. 1 plant and 6 shaft kilns at the No. 2 plant, has a total capacity of 160 tons per day. The hydrating plant has an output of about 80 tons of hydrated lime per day. Both plants are within a few miles of Bellefonte.

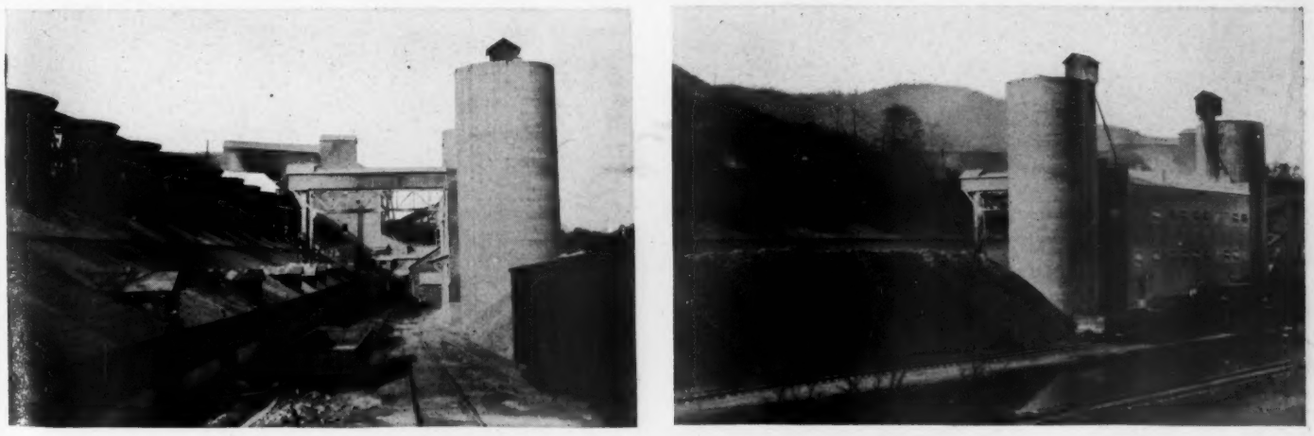
### *Stone Strata Lie at a Steep Angle*

The deposit, which is a high-calcium limestone, has been folded and the strata lie at a steep angle with the horizontal as indicated in several of the illustrations. Some primary drilling is done with well drilling machines but the present face lends itself readily to drifting with air drills. The stone for the kilns is broken and loaded by hand and moved to the kilns in cars, the quarry floors at both plants being practically on a level with the top of the kilns.

At the No. 1 operation the stone for the crushing plant is excavated and loaded by a 1¼-yd. 50-B Bucyrus steam shovel which is mounted on caterpillar type treads. The rock is loaded direct to two Easton end dump steel cars, with a capacity of about 7 tons of rock each, which are then pulled up an incline to the crushing plant.

### *Crushing and Screening Plant*

A special 48- by 56-in. two-drum hoist furnished by the Vulcan Iron Works, Wilkes-Barre, Penn., is used to handle the cars on the incline. This is driven by a 150-hp. General Electric slip-ring motor which has a starting panel with automatic contactors and relays to regulate and control the acceleration and thus keep the power demand down within certain limits. The hoist also has air-operated brake bands and frictions and is controlled from a small house above where the operator has a clear view of the incline and dumping point. Also located in the hoist room is a new Ingersoll-Rand 650 C.F.M. compressor for supplying



*Kilns and hydrating plant of the Chemical Lime Co., Bellefonte, Penn.*

air for the drilling operations. It is driven through an endless leather belt and Lenix drive by a 125-hp. General Electric synchronous motor.

The cars dump to a hopper from which the rock is fed by a 48-in. inclined pan conveyor feeder to a 42- by 48-in. Traylor jaw crusher. The crushed material falls to a 30-in. by 250-ft. belt conveyor which in turn discharges to a second 30-in. belt conveyor 550 ft. long carrying over to the screening and recrushing plant. These conveyors are driven by individual motors through speed reducers and are interconnected with the crusher feeder in such a way that they can only be started in correct sequence opposite to the flow of the material. Also, in case one of the conveyors stops, the feeder is automatically stopped. In order to further prevent any trouble from overloading, the first belt is run at a speed of 225 r.p.m. and the second at 250 r.p.m.

At the screening plant the second conveyor discharges to a 5-ft. by 24-ft. Traylor revolving scalping screen from which the tailings are spouted to a No. 7½ Traylor reduction crusher. The throughs pass to a 4-ft. by 20-ft. Austin revolving screen for further separation. A No. 8 Traylor fine reduction crusher is also used for reducing the coarser sizes. The finer sizes (minus 1-in.) are separated over a 4-ft. Hum-mer vibrating screen.

Arrangements have been made to wash all sizes up to 2¾-in. by drawing them from the bins on to a belt conveyor which carries over to a 4-ft. by 20-ft. revolving screen located alongside the plant. This screen has a 10-ft. scrubber section and is equipped with water jets. The washed material discharged from the screen is carried either way on a reversible belt conveyor to discharge into cars on either of two loading tracks. The fines and water are washed down into a hopper car on a track directly below and given to the railroad company.

### *Lime Burning and Hydrating at No. 1 Plant*

The 10 shaft kilns at the No. 1 plant are in one row and are spaced far enough apart so that the fire boxes and firing floors are between them.

They are coal-fired, open-top kilns with two fire boxes per kiln and are 45 ft. high with 12-ft. diameter steel shells. Steam is used under the grates. Coal is received in railroad hopper cars and dumped from a trestle alongside the row of kilns, thus requiring a minimum of rehandling.

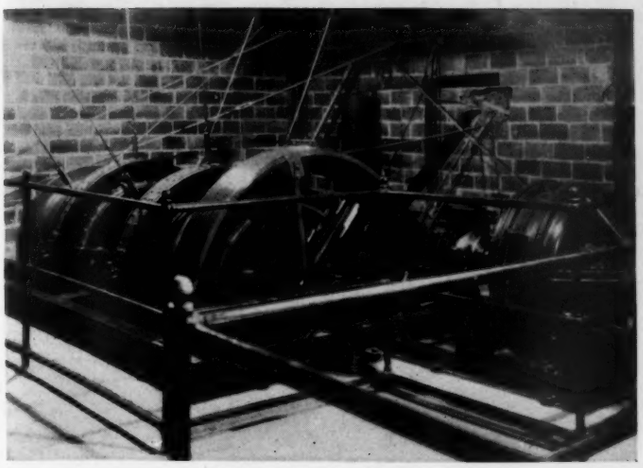
The burned lime, after being allowed to cool on the floor alongside the kilns, is wheeled to a No. 1½ Sturtevant open-door crusher located at the floor level in the kiln shed, where it is crushed down to pebble size. The crushed lime is then carried across to the hydrating plant by means of a steel cased bucket elevator and a belt conveyor spanning the tracks.

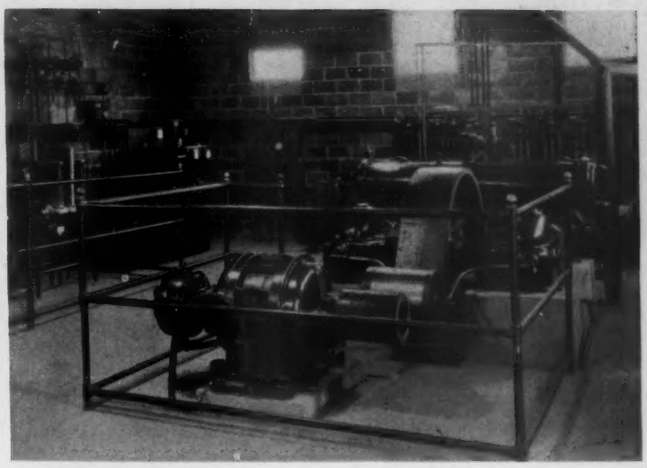
At the top of the hydrating plant the conveyor discharges to a Hum-mer vibrating screen where pebble lime is separated out from the finer material and the fines are further pulverized in a hammer mill. These two products fall to two circular steel bins of about 60 tons capacity each, from which they are drawn and loaded to railroad cars by means of spouts. The pulverized lime bin is also equipped with a packer for bagging the fine material.

For hydrating, the lime is diverted to a steel bin of about 100 tons capacity located at the end of the hydrating plant from which it is fed to a No. 5 Schultess continuous hydrator located on the first floor. This machine has a capacity of about 4 tons per hour and is driven by a 15-hp. motor. The hydrated lime is discharged to a bucket elevator and carried up to the first of two 8-ft. Sturtevant air separators, where a high quality superhydrate is removed. This product is said to have a fineness of 99% minus 325 mesh and 100% minus 200 mesh and is

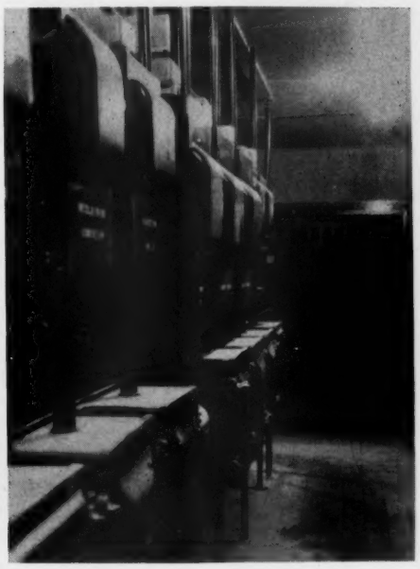
***Quarry at No. 1 plant, showing inclined strata, and incline from quarry to primary crusher***

***Lime kilns and pulverizing plant, and, at right, quarry face at No. 2 plant***





***Hoist and compressor unit located in new hoist house***



***Motor starters and switches with capacitor at right***

shipped to points in New England and as far distant as Iowa. It is used in the manufacture of paints, paper, chemicals, sprays, insecticides, etc.

The tailings from this separator are spouted to a second separator below, where standard mason's hydrate is taken off, running 98% minus 200 mesh. Tailings from the second separator fall to a McGann beater mill or hammer mill and are sold as agricultural hydrate.

Each air separator is driven by a 7½-hp. motor. The total of the motors in the hydrating plant is only 53 hp., with a total power consumption of 40 hp., which is lower than most plants.

The two grades of finished hydrate from the separators are conveyed to two circular steel bins of about 45 tons capacity each, from which they are bagged by means of a 4-tube Bates packer under each bin.

The crushed quicklime from the kilns can be put into storage in a concrete silo at one end of the hydrating plant. This silo, which is 30 ft. in diameter and 85 ft. high and has a capacity of about 1500 tons of quicklime, is arranged with a long steel-cased bucket elevator and with screw conveyors above and below for filling and drawing out. The one elevator, with suitable gates and spouts, serves for both filling and drawing out.

At the opposite end of the hydrating plant a duplicate silo, capable of holding about 1000 tons of hydrate, serves as a storage for hydrated lime. Both silos have 9-in. walls and are of reinforced, monolithic construction.

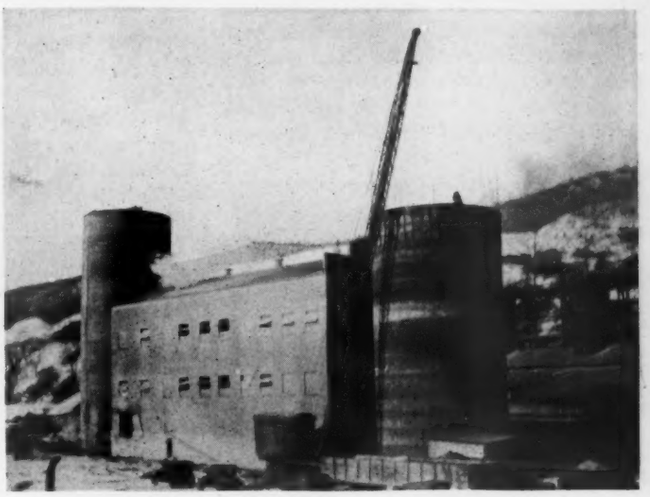
### *Concrete Silos Poured in Record Time*

The silos were constructed by the company's own men in December, 1930, during extremely cold weather with no apparent bad effects and in fact stand as excellent examples of good workmanship. They are also interesting in that they were poured in record time, the first one in 10 days and the second one in 7 days.

Metaform units, 2 ft. by 2 ft. in size, furnished by the Metal Forms Corp., Milwaukee, Wis., were used as forms, being clamped together to make the circle. The concrete was poured continuously and as fast as it set up the forms at the bottom were removed and reassembled on top to form new courses. The concrete was elevated and placed by means of a bucket which was handled by the Industrial Brownhoist gasoline crane normally used for stockpiling. The boom of the crane was lengthened as indicated in one of the illustrations. The silos were kept heated inside and covered with tarpaulins as much as possible to protect against freezing, and although the temperatures were below zero during part of the time, there was no appreciable scaling.

### *Lime Shipped in Special Hopper Cars*

Shipments of quicklime are now being made in a new type of special hopper car



***Concrete silos under construction***

*Crushing plant for commercial stone*

with a closed top. These cars, which carry a load of 45 tons of lime, are furnished by the Pennsylvania railroad and are constructed as shown in two of the accompanying illustrations. They are loaded by spouting the material through a set of openings equipped with water-tight hinged doors on top and are self-emptying through two hoppers with slide gates below.

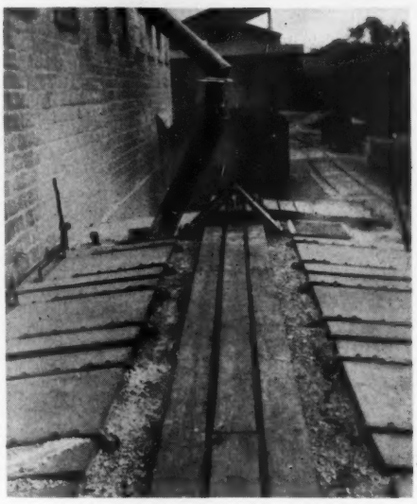
### *Pulverizing Limestone at No. 2 Plant*

The six shaft kilns at the No. 2 plant are of the same general construction and arrangement as at No. 1 plant, except that they are somewhat shorter and that no steam is used in the fireboxes.

At the pulverizing plant the quarry cars are dumped to a No. 7½ Allis-Chalmers gyratory crusher and the crushed rock conveyed to storage bins above a Jeffrey mill. From this mill the material is conveyed to a 6-ft by 60-ft. rotary dryer and the dried material carried back on a belt conveyor and elevated to two Hum-mer vibrating screens. These screens are equipped with 8 mesh and 16 mesh wire cloth (or such other mesh as may be desired) to separate out certain coarser sizes.

A Kent mill is used for further pulverizing of the limestone and two 10-ft. Sturtevant air separators are used for classifying the finer sizes. About a dozen different sized products are made for different purposes down to a fineness of 95% minus 325 mesh.

*Special type car for lime shipments*



*Loading hopper-bottom car with pebble lime*

### *General*

Both plants are served by the Bellefonte Central railroad, which connects with the Pennsylvania railroad at Bellefonte. Eléctric power at 23,000 volts is furnished by the West Penn Power Co. and is transformed down to 440 volts in the company's own substation. General Electric motors are used throughout, these being across-the-line high-starting torque motors, except in the larger sizes. Various kinds of speed reducers are used, incuding De Laval, James, Foote and Cleveland.

The offices of the company are at Bellefonte, Penn. O. H. Nance of Baltimore, Md., is president; H. D. Brigstocke is vice-president; H. G. Pattee, secretary-treasurer; and R. S. Walker, general manager. S. H. Smith and H. H. Pifer are superintendents.

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## Retail Sales of Building Materials Studied

RETAIL SALES of building materials are highest per population in Kansas and lowest in Georgia, according to a comprehensive analysis of the major retail markets of the nation just completed by Erwin, Wasey and Co., international advertising agency with headquarters in New York and offices in six leading cities of the country.

The analysis, said to be the most thorough and comprehensive of its kind ever made in this country, is based upon the first official census of retail sales made by the United States government in connection with the 1930 census, and has been published in book form by Erwin, Wasey and Co.

In the analysis the retail sales index gives 100 as the average for the country, with Kansas retail sales placed at 181, or 81% above average, and with the retail sales of Georgia placed at 23, or 77% below average.

Among the larger cities, Flint, Mich., ranked highest, with retail building material sales listed at 284, or 184% above the average for the country. New Bedford, Mass., ranked lowest, with sales placed at 25, or 75% below average.

The analysis shows that building material sales are below average in 21 of the 48 states. States below average were shown by the survey to be: Alabama 71% below average, Arkansas 58% below, Florida 24% below, Georgia 77% below, Kentucky 49% below, Louisiana 52% below, Maine 23% below, Maryland 19% below, Massachusetts 21% below, Mississippi 64% below, Missouri 13% below, New Hampshire 28% below, New Mexico 9% below, North Carolina 75% below, Oregon 5% below, Pennsylvania 14% below, South Carolina 74% below, Tennessee 49% below, Vermont 13% below, Virginia 48% below, and West Virginia 62% below.

States having unusually good building material sales were shown by the survey to be: Arizona 55% above average, California 46% above, Colorado 19% above, Connecticut 17% above, Delaware 69% above, Idaho 18% above, Illinois 20% above, Indiana 15% above, Iowa 61% above, Kansas 81% above, Michigan 55% above, Minnesota 14% above, Montana 32% above, Nebraska 80% above, Nevada 20% above, New Jersey 40% above, New York 6% above, North Dakota 52% above, Ohio 10% above, Oklahoma 18% above, Rhode Island 16% above, South Dakota 69% above, Texas 24% above, Utah 30% above, Washington 4% above, Wisconsin 61% above, and Wyoming 51% above.

In dollars and cents New York state ranked first in retail building material sales, Illinois second, California third, Michigan fourth, Pennsylvania fifth, and Ohio sixth. The analysis shows that building material sales in New York state amounted to $230,974,000, Illinois $157,751,000, California $143,702,000, Michigan $129,537,000, Pennsylvania $126,785,000, and Ohio $126,658,000.

Total retail sales of building materials throughout the United States, the analysis shows, amounted to the huge sum of $2,125,203,000, of which $942,774,000, or less than half, was expended in the 370 larger cities.

# Method and Cost of Dredging Sand and Gravel, Portland Gravel Co., Portland, Ore.*

By Howard F. Puariea†
President, Portland Gravel Co.

THE Portland Gravel Co., Portland, Ore., was organized on March 20, 1925, and at once started construction of the clamshell dredge *Boulder* from designs by H. P. Warren and the writer. This dredge was put in operation on the Willamette river near Portland, Ore., in July, 1925. Few alterations were necessary and the dredge has been in almost constant operation since that time. On May 1, 1926, the company purchased the pump dredge *Sandy* from the Columbia Sand Co. This dredge was designed and built in May, 1924, by the writer. With this equipment the Portland Gravel Co. had the largest capacity in the Portland district and during 1926, 1927 and 1928 furnished sand and gravel for all the major work in the vicinity and in addition supplied customers at Astoria, Ore., and Longview, Wash. The purpose of the company is to wholesale material delivered on customer's barges alongside the company's dredges. No attempt has ever been made to enter the retail business.

### Geology

The gravel used in the Portland district comes mostly from the bed of the Willamette river near the city of Portland. Outlying districts are supplied partly by material from dry pits and banks. The gravel is found in the river bars containing sand, gravel, silt and débris. In the part of the river near Portland the bars shift but little, due to the narrow channel and reefs of solid rock which protect the head of the bars. Many of these gravel bars contain water-soaked chips deposited in the river by the paper mills at Oregon City, 12 miles upstream. When these chips occur in quantity they ruin the deposits because they cannot be separated economically; bars containing them are avoided by moving the dredge, unless there is a market for fill material which can be loaded directly into barges and not run through the plant. In workable bars the upper gravel to a depth of 10 to 15 ft. generally contains driftwood and débris but can usually be run through the plant without ruining the product. Beyond this depth the deposits are exceptionally clean.

The gravel ranges in size from pea gravel to boulders 8 to 10 in. in diameter, and is mostly loose, although there are sections of hardpan and cemented gravel which are avoided if possible when dredging. The gravel is largely basalt and is hard and sharp. There are sections in the river that contain a high percentage of decomposed or rotten rock that when mixed with good gravel spoils it for anything but fill.

The sand consists largely of rounded particles of basaltic material and rarely contains more than 10 or 15% of quartz.

### Dredging Conditions

Near Portland the river deposits have been reworked many times, and prior to 1921 most of the dredges dumped the boulders and excess sand back into the river. This refuse practically covers the bars and makes dredging difficult. Since 1921, Government engineers have required all dredges to crush the oversize or move it ashore. Excess sand is still wasted and causes considerable trouble.

The sand as taken from the river is dirty and contains up to 25% of excess fines. In order to build up or properly grade this material it is necessary to waste these fines and to add the coarse material obtained from the crusher fines. The crusher makes about 25% of fines below ⅜ in., so there is plenty of this material to add to the sand. The prepared sand weighs about 2600 lb. per cu. yd. and is so harsh that it requires much more work to put in place than Columbia river sand, although it is stronger.

When sand is saved, about 15 to 18% of the material dug is wasted back to the river. When wasting sand, this proportion increases to about 40%. On an average about 30% of the finished gravel is crushed material.

The river is full of old snags and buried trees which would prove disastrous to a ladder dredge. With the clamshell dredge it is possible to dig around these obstructions. During the freshet period in winter, dredging is further complicated by swift water and drift which fills the excavation with trash and drifting waste sand.

### Choice of Method

A clamshell dredge was selected as being the cheapest means of recovering the gravel. The decision was based upon the volume needed, the conditions in the river bed, and the great depth of the deposits from which a suction or ladder dredge could not recover material economically.

### Prospecting and Sampling

Prospecting is done by moving the dredge from one bar to another. In some of the bars the material is fine and in others coarse. The different sizes of gravel are run through the dredge, finished, and samples taken and put through sieve tests. If necessary, changes are made in the screens to grade the gravel to meet specifications. The average weight of the gravel as prepared for market is 2850 lb. per cu. yd. There has never been any attempt to estimate accurately the reserve in these river bars, as there is an unlimited amount of material which will last for years to come.

The prospecting and sampling of Columbia river sand is handled in the same way. A screen test is made of every barge load to determine the fineness modulus. The sand samples of both Willamette and Columbia river sand are taken from the barge with a sand auger. This auger is made from a piece of 1-in. pipe with slots cut in it at 6-in. intervals for a length of 5 ft. A fin is welded on one edge of each slot so that in turning the pipe it will take a sample at each fin. A sample is obtained in this manner at every few feet across the barge and is then tested with standard sieves.

Columbia river sand prepared for market will average 2250 lb. per cu. yd. There is an unlimited amount of sand in this section of the river.

### Dredge "Boulder"

The material is lifted by the clamshell to the overhanging hopper on the end of the dredge (Fig. 1). This clamshell bucket was built by the company from their own patterns and is made of cast steel with lips, pins, sheaves and all wearing parts of manganese steel.

The clamshell holds 40 cu. ft. when level full. It is rigged with two 1-in. cables 225 ft. long, one a closing line and the other a trip or holding line. The closing mechanism is the same as that of the well-known Williams 2-line clamshell bucket. An ordinary stiff-leg derrick is used. The boom is of wood and is 65 ft. long with two 30-in. diameter sheaves in the top which lead the cables directly to the hoist through two 18-in. lead blocks swung from the A-frame. This method of rigging works well, as the boom seldom travels more than a quarter turn. No turntable is used, but pull lines from each side of the boom provide radial movement. The derrick is designed to lift 20 tons and the hoist for a straight pull of 10 tons.

The clamshell discharges into a 12- by 14-ft. hopper built of wood. Three sides of the hopper slope and the fourth side is vertical and is fitted with a steel gate 14 in. square which is operated by hand. Material is fed through this gate into a cylindrical trunnion-

*Abstract of U. S. Bureau of Mines Information Circular 6626.
†One of the consulting engineers, U. S. Bureau of Mines.

type trommel turning 30 r.p.m. and fitted with ¼-in. mesh wire cloth made of spring steel. This screen dewaters the gravel before discharging it on to the No. 1 conveyor belt. It also removes the sand from the gravel. No extra water is used in this operation.

The No. 1 conveyor belt is level, 30 in. wide, 75 ft. between centers, and has an average capacity of 200 tons per hour at a speed of 250 ft. per min. It discharges to a washing table 5 ft. long, 3 ft. wide and 18 in. deep, extending into the main screen. This washing table is level and is lined with ¾-in. steel plate bolted to the bottom and sides. The material is broken up and washed from this table into the trommel by a 5-in. stream of water delivering about 600 gal. per min. In the trommel the material is washed again by a system of jets fed by a 3-in. pipe delivering about 200 gal. per min. against a head of approximately 60 ft. Valves placed at the washing table regulate the amount of water passing through the 5-in. main and the 3-in. jet system. Both are supplied by an 8-in. pump, belt-driven from the main countershaft, as shown in Fig. 1. The surplus water from this pump fills the 3-in. fire main and also cools the main Diesel engine. The balance is returned to the river through the drip pans under the conveyor belts.

The main trommel has a standard frame supported on 30- by 5-in. trunnion wheels at the charging end and the usual shaft at the discharge end. It is driven by a belt from the main-engine shaft through a bevel gear and pinion at 11 r.p.m. This screen has a slope of 22 in. in its length of 20 ft. It has two jackets. The inside section is 46 in. in diameter and its first 16 ft. is of ⅜-in. plate with holes 1⅝ in. square spaced diagonally across the section. The lower 4 ft. is a punched plate with 3-in. round openings. The first jacket, 6 ft. in diameter and 16 ft. long, is made of 5/16-in. plate with 1⅛-in. square holes. The second jacket is 8 ft. in diameter and 8 ft. long and is built in two sections of spring-steel wire with ⅜-in. openings. A screen of this design was used to save space.

The oversize boulders pass directly from the screen to a 48-in. disk crusher set to crush to 1-in. size and discharging to the No. 1 belt conveyor over the No. 3 conveyor (Fig. 3).

The No. 3 conveyor belt, which is 20 in. wide, 58 ft. between centers, and travels 250 ft. per min., carries an average of 42 tons per hour. This method of mixing the crushed stone with the gravel makes a uniform and satisfactory product.

Out of 100 tons of material dug by the dredge, about 40 tons will pass the ⅜-in. screen and the dewatering screen. This fine material is usually wasted, but when making sand about 25 tons out of the 40 tons of fines is saved. The 60 tons of material larger than ⅜ in. is screened and crushed to the desired size. When making two sizes of gravel simultaneously there will be about 25 tons of ⅜- to 1⅛-in. material and about 35 tons of 1⅛- to 3-in. gravel in the material larger than ⅜ in.

The finished material is delivered by conveyor belts to barges alongside. It is possible to load a barge on each side simultaneously, and loading in this way is necessary for paving jobs where the material must be furnished in two sizes.

The No. 2 conveyor belt is 24 in. wide, 54 ft. between centers, and travels 225 ft. per min. This belt carries an average of 70 tons of ⅜- to 2-in. finished material per hour to No. 2A conveyor, which is a 24-in. belt on 28-ft. centers, traveling 225 ft. per min. and discharging to the barges on one side.

The No. 4 conveyor belt is 20 in. wide, 48

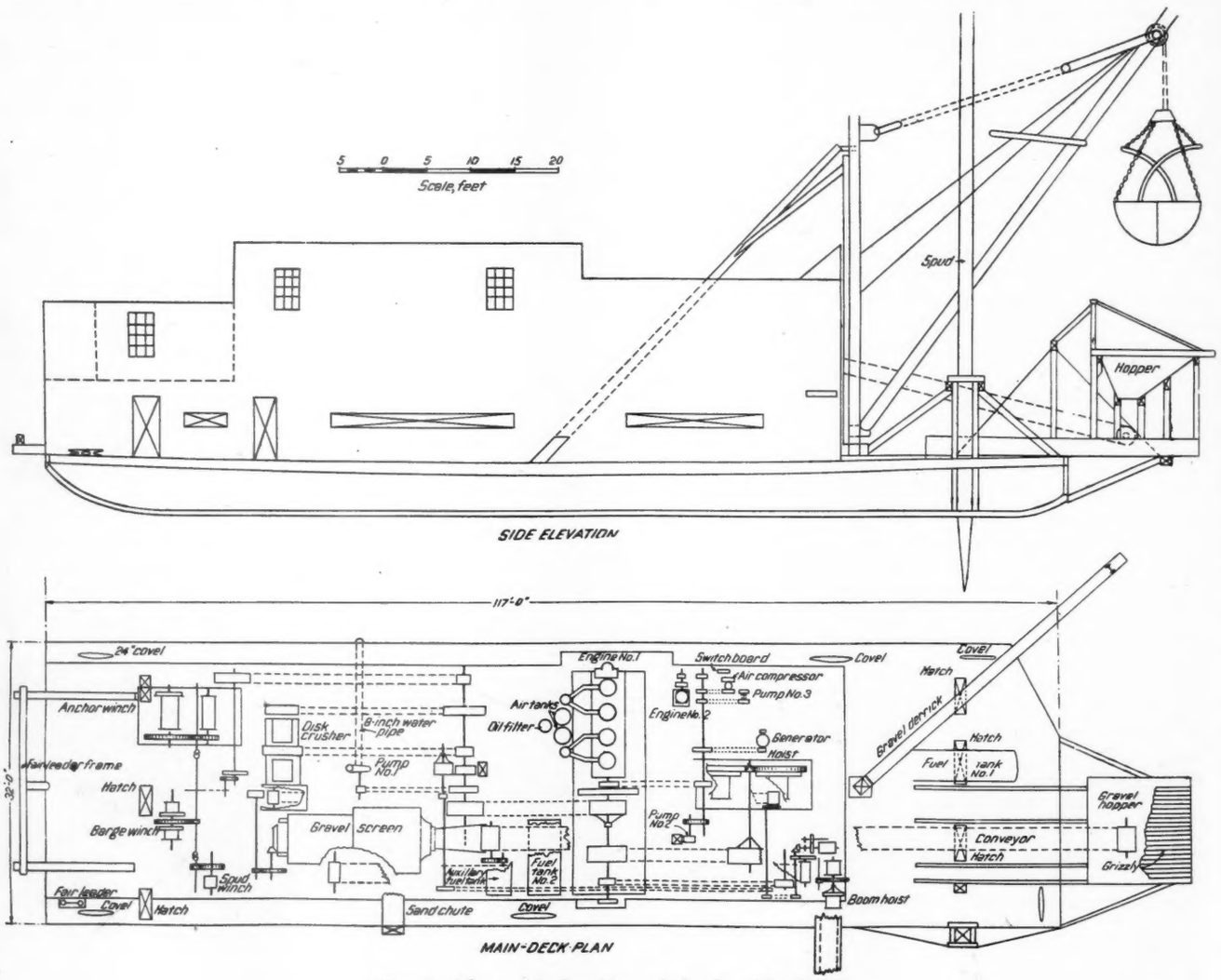



***Fig. 1. Plan and elevation of dredge "Boulder"***

ft. between centers, and travels 225 ft. per min. This belt carries an average of 42 tons of ⅜- to 1-in. finished material per hour directly from the main screen to the barges on the side of the dredge opposite that served by conveyor No. 2A.

The minus 1⅛-in. plus ⅜-in. material can be delivered to either No. 2 or No. 4 conveyor by shifting a gate in the hopper just below the main screen. This is done in order to eliminate the shifting of barges from one side of the dredge to the other. Fig. 3 shows a complete flow sheet of the dredge.

Directly under the sand jacket on the main screen there is a sand settling box of the usual V-shaped type with a gate in each side, one leading overboard and the other to a 16-in. screw conveyor 15 ft. long which discharges the settled sand to the No. 4 conveyor and thence to the barge. The waste gate is adjustable to regulate the amount of fines going overboard. The only wash water used is that coming through the main screen. The natural sand is built up, as previously stated, with the fines from the crusher. This system results in a uniform and satisfactory product.

All belts are made of 28-oz. 5-ply duck and have ⅛-in. rubber cover and 1/16-in. rubber back. All conveyor rolls are ball-bearing and all conveyors are fitted with drip pans continually flushed with water to carry the spill back to the river. The conveyors are driven from the main engine through shafts and pulleys by rubber belts. The power is furnished by a 4-cylinder full Diesel engine, 14-in. bore and 17-in. stroke, developing 240 hp. at 257 r.p.m. and mounted on a foundation of steel beams and concrete. This power plant is serviced by a 10-hp. auxiliary engine driving the usual air compressor, oil and water pumps, and generator. The hoisting machinery, anchor winches, barge winches and clutches were all built locally from designs furnished by the company.

The dredge hull is of wood and is 117 ft. long, 32 ft. wide and 6½ ft. deep. No spuds are used, but the dredge is held by four anchors, one at each corner to permit movement in any direction.

There is a 4-in. fire and barge pump that can be driven from either the main or auxiliary engine.

The average capacity of this dredge is 50 cu. yd. per hour.

Living quarters for the crew are provided on the upper deck of the dredge.

The barges have a capacity of 300 to 500 cu. yd. and are all built of wood.

### *Dredge "Sandy"*

The *Sandy* is a suction dredge with a wooden hull 90 ft. long, 30 ft. wide and 5 ft. deep. The sand pump has a 10-in. suction and a 12-in. discharge. The impeller has three ports and is 28 in. in diameter. It is the closed type and is made of carbon steel. The pump housing is cast iron with a cast-iron liner on each side of the impeller. The main pump housing is replaced when worn, as this is cheaper than relining while dredging this kind of material. This pump makes 410 r.p.m. and operates against a head of 22 ft.

The main engine is a 75-hp., 2-cylinder semi-Diesel of 12-in. bore and 15-in. stroke, and makes 300 r.p.m. It is set on steel I-beams which extend far enough to hold an outboard bearing which supports a tail shaft and a clutch pulley. There is another pulley on this shaft which drives the anchor machinery through a second clutch pulley.

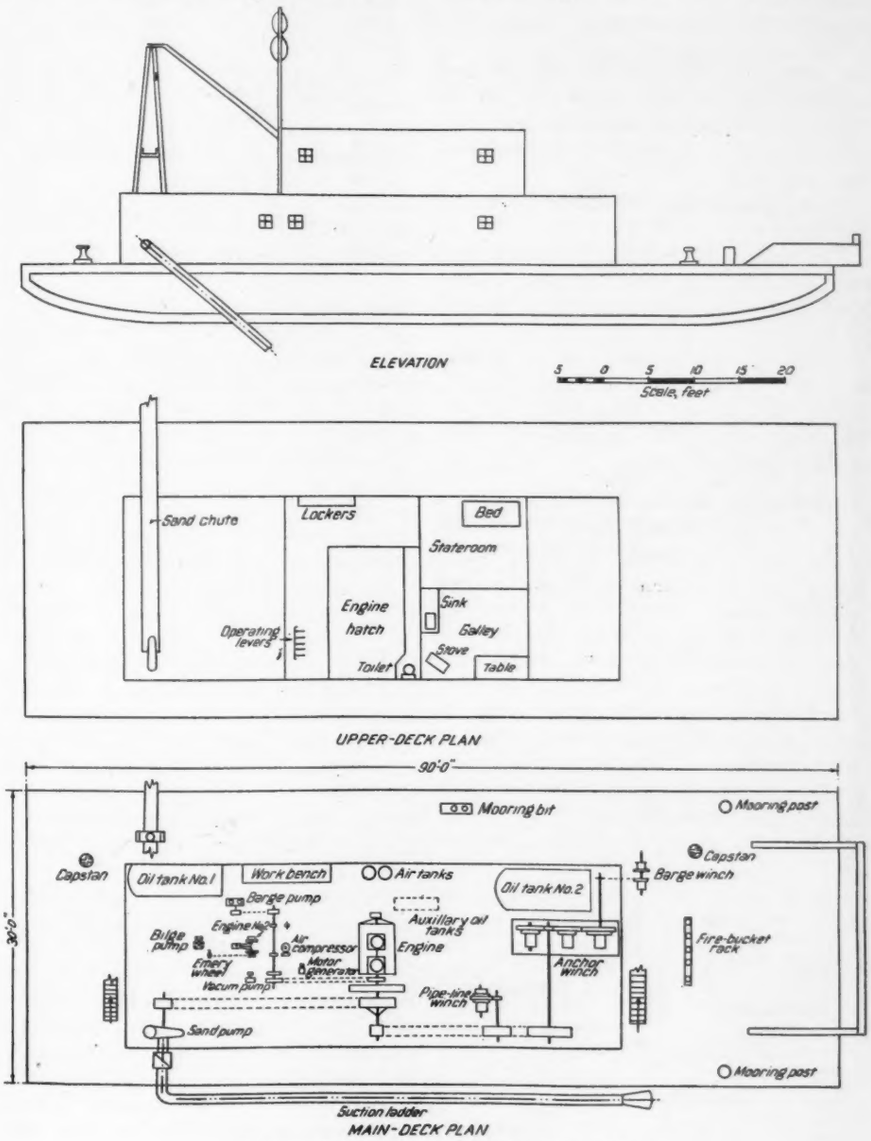
A 3-hp. gasoline engine furnishes auxiliary power for the generator and air compressor. A 3-in. fire and barge pump is driven from the main engine.

The sand pump is driven by a belt from the main engine through a clutch to permit flushing out the pump.

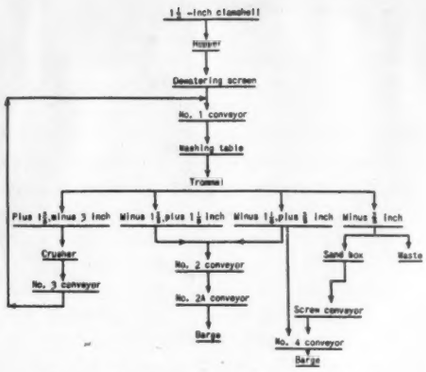
There are two forward anchors on this dredge. No spuds are used, as the current in the river holds the dredge in position. There are also three live drums attached to the anchor winches for moving barges alongside. These winches were built locally to fit the conditions and are driven from the main engine through clutches, as is also a small 2-drum winch that hoists the suction pipe.

The suction pipe line is made up of two 20-ft. lengths of standard 10-in. pipe welded end to end and stiffened by three T-irons welded at equally spaced intervals around this pipe and extending 10 ft. along each section. A suction nozzle made of welded plate with a suitable screen over the end completes the suction line. This is connected to the main pump by a swivel joint and rubber suction sleeve to permit the pipe to swing vertically. The suction line hangs over one side of the hull on two davits. A cutter or agitator is not needed, as the sand is loose. The pump handles from 18 to 20% solids.

The sand pump discharges into a stationary cylindrical screen built up of three sections, each having a different size of screen and covering one-third the circumference of the cylinder. The screen is mounted over a deep wooden flume. When in operation the




***Plan and elevation of dredge "Sandy"***




***Flow sheet of dredge "Boulder"***

screen is stationary and the bottom section is the only part in use. In changing sizes, the screen is turned so that the proper screen is at the bottom and the whole is then locked in position.

The oversize from this screen is rejected over the stern of the dredge. The sand drops through the screen into a deep flume, which can be raised or lowered, and is delivered to the barges alongside. About 20% of the material pumped is wasted back into the river. The average capacity of this dredge is 175 cu. yd. per hour.

To obtain different grades of sand it is only necessary to move the dredge to different sand bars.

Living quarters are provided on the dredge for the crew.

The barges loaded at this dredge all have sand boxes built on them fitted with sliding steel gates. These gates are at the bottom of the box at the deck level. The flume from the dredge extends across the barge and loading is started at one end and continued to the other, the water being forced through the gates by the sand. The gates are raised as the sand fills the boxes.

### *Difference in Cost of Producing Gravel and Sand*

The cost of producing gravel is much higher than that of pumping sand, for the following reasons: The volume produced is considerably smaller, the gravel deposits are much more difficult to work, the maintenance on machinery is much higher, the cost of crushing is added, the power cost is higher, and the labor cost is twice as much.

The operation of pumping sand is simple and there are practically no interruptions, as the Columbia river deposits are clean and the percentage of waste material is fairly low.

The personnel and wage rates are as shown. All crews board themselves.

PERSONNEL AND WAGE RATES

| Dredge *Boulder* | Per day | Per month |
|---|---|---|
| Foreman | .... | $175 |
| Clamshell operator | .... | 175 |
| Hopper man | $4 | ..... |
| Bargeman and watchman | 5 | ..... |
| Dredge *Sandy* | | |
| Foreman and operator | .... | 175 |
| Bargeman and watchman | .... | 100 |

TABLE 1. COST OF PRODUCING GRAVEL
Dredge *Boulder*. Tons gravel produced, 84,000
Period covered, January 1-December 31, 1929

| | Cost per ton |
|---|---|
| Power, including labor, repairs, fuel, oil, etc. | $0.0520 |
| Clamshell derrick, including labor, repairs, cables, oil, etc. | .0292 |
| Conveyors, including labor, repairs, oil, etc. | .0172 |
| Screening, including labor, repairs, etc. | .0240 |
| Crushing, including labor, repairs, oil, etc. | .0378 |
| Miscellaneous operation, including salaries, superintendence, miscellaneous repairs, etc. | .0480 |
| Royalty | .0600 |
| Depreciation | .0690 |
| Total operating cost | $0.3372 |

TABLE 2. COST OF PRODUCING SAND
Dredge *Sandy*. Tons produced, 126,500
Period covered, January 1-December 31, 1929

| | Cost per ton |
|---|---|
| Power, including repairs, fuel, oil, etc. | $0.0080 |
| Pumping, including pump repairs, parts, oil, etc. | .0132 |
| Miscellaneous, including all labor, repairs, oils, cables, flume repairs, etc. | .0570 |
| Royalty | .0437 |
| Depreciation | .0220 |
| Total operating cost | $0.1439 |

## Adhesion of Asphalt to Sand Grains

IN a recent issue of *Roads and Streets*, Victor Nicholson, engineering chemist for the Chicago Bureau of Streets, discusses the adhesion of bituminous materials to sand grains in paving mixtures. Mr. Nicholson is the author of a well-known paper in which he relates the stability of asphalt paving mixtures to the angularity of the sand grains used. Dow, commenting on this paper, gave as a reason for the high stability obtained with certain sands that their surfaces were covered with films of colloids, a theory which was partially indorsed by Hubbard.

Nicholson investigated this theory, using the method of Prof. Bouyoucos, of the University of Michigan, for removing and determining colloids on sand grains. The sand with water and some alkali is agitated in the familiar stirrer used for making malted milks at soda fountains. The water containing the colloids is then poured off and tested by a hydrometer, the density corresponding to the percentage of solids present according to well-known laws.

Three natural sands and crushed quartz were tested, the colloids being removed by the method given from half of each sample. The absorption for each half was determined by the colorometric method of Dow. The stability was determined for two sets of mixtures, one made with 92% sand and 8% asphalt, the other with 80% sand, 10% mineral filler and 10% asphalt. All the sand was carefully freed from 200-mesh material before the colloids were removed, and after removal of colloids the sand was again sieved to remove 200-mesh. The samples mixed with asphalt and asphalt and filler were tested for stability by the extrusion method of Hubbard.

A table in the article gives the test results and the characteristics of the materials used in full detail. And they leave no doubt that the colloids on the surfaces of the sand grains absorbed more asphalt and tended to show somewhat higher stability when no filler was added. For example, a Washington sand with 1.5% colloids, mixed 92% sand and 8% asphalt, had a stability of 2033 lb. natural, and 1833 lb. after colloids were removed.

According to the paper, when these same sands were made into sheet asphalt mixtures, the samples from which colloids had been removed showed the highest stability, as the figures in the table show. It is the conclusion of the author of the paper that the slight difference in results is in all probability due to the fact that the colloids on the grains tend to act as filler. There is also a possible variation due to changes in grading made during the removal of the colloids. And finally there is the fact that the differences are no greater than the variations that are possible in making the stability tests with all due care.

In no case, the author concludes, are the differences between the plain sands and those from which the colloids have been washed great enough to account for the differences shown in his former paper.

## Feldspar Industry in 1931

THE FELDSPAR industry in 1931 was characterized by further decreases in tonnage and value of both crude and ground spar, an advance summary of the industry issued by the Bureau of Mines stated. The crude feldspar sold or used by producers in the United States in 1931 amounted to 147,119 long tons, valued at $5.85 a ton. These figures show a decrease of 14% in quantity and 19% in value as compared with 1930.

The average value of crude spar per ton in 1931 was the lowest since 1919.

Feldspar was reported as having been mined and sold or used by the producer in 1931 in 13 states. Named in the order of their importance, they were: North Carolina, New Hampshire, South Dakota, Maine, Virginia, New York, California, Colorado, Minnesota, Connecticut, Arizona, Pennsylvania and Nevada. The Atlantic seaboard states from Maine to North Carolina produced 86% of the total output in 1931. North Carolina reported 59% of the total output.

In 1931 there were 29 commercial grinding mills operated in 14 states.

Of the quantity of ground spar sold in 1931, 132,542 short tons, valued at $1,630,917, was domestic feldspar, and 11,382 tons, valued at $222,476, was imported.

# Plan to Broaden Credit Structure

ONE OUTSTANDING manufacturing concern with which many rock products producers deal has publicly announced that it will adopt the suggestion of the Banking and Industrial Committee of the Second Federal Reserve District (New York) to immediately extend needed credit to industry. This concern is E. I. du Pont de Nemours and Co., Wilmington, Del. (and its subsidiaries), which announces it will take short-term trade acceptances from responsible customers in payment for goods purchased.

The reasons given are these, and the example of the du Pont organization could well be followed by others:

It will assist legitimate business to obtain needed credit from the banks.

It will increase bank deposits.

It will serve as a means of expanding the Federal Reserve Banks' outstanding credit.

All of which should tend to stimulate business, stop further deflation, and accelerate the return of normal conditions.

The trade acceptances received by the du Pont companies in payment for products sold will be discounted at banks or sold to banks through note brokers.

A facsimile of a trade acceptance form is reproduced with the announcement and is shown herewith. A little study of this will fully explain its use.

Let us say, for example, that a crushed stone producer has a state highway contract and must produce 100,000 tons of stone. He has immediate need of 25,000 lb. of explosives, but he has no ready cash, and his local bank has closed, or is unwilling to extend credit on a mere promissory note. The producer will be unable to make collections from the contractor or state highway department for 60 days.

Under such conditions, if he is a responsible customer of the explosives manufacturer, he "accepts" the manufacturer's trade acceptance for the price of the explosives as a draft due in 60 or 90 days. His acceptance is evidence that he has received the explosives, that they are satisfactory, and that he has put them to use to make crushed stone for which payment will be received. The trade acceptance then becomes currency to all practical purposes.

It is to be hoped other manufacturers of equipment and supplies for the rock products industry will do likewise, for there is considerable business in sight for all, but scarcity of ready money and credit, especially in many of the smaller communities, is holding up this business.

The trade acceptance is not new, but it has not been as generally used as it could be. It differs little from a regular time-draft, except that it is based on an actual exchange of specific goods, and consequently has as security the goods themselves. Since there is little chance of the price of basic commodities receding further, there is no good reason why manufacturer, consumer or banker should not make considerable use of these trade acceptances at the present time.

The manufacturers, especially if they are large and well financed organizations like the du Pont companies, are in a much better position to carry the credit than many of their customers in small communities where bank failures and tight money conditions make all business transactions difficult, even though the local producer has ample business in hand to justify the financing in his home community.

## Federal Trade Commission Inquiries

THE Federal Trade Commission reports that the first of a series of reports on cement price bases has been sent to Congress. This is entitled "The Basing-Point Formula and Cement Prices" and will be issued soon in printed form. A summary of this report was published in the April 9 issue of Rock Products.

It also reports that in its study of competitive conditions in the cement industry in addition to field work which is almost completed, classifying and assembling information obtained through questionnaires to various parties involved in the distribution and use of cement is well under way and will be used in preparing a report on this subject.

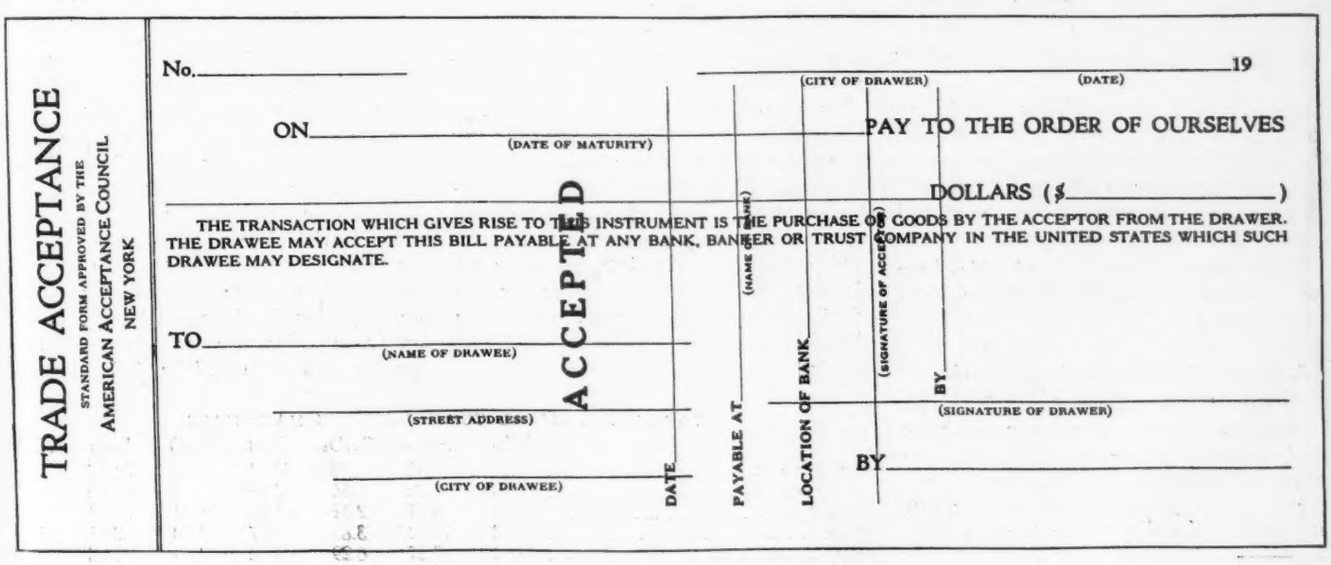
In its investigation of the building materials industry, the field work has been completed in connection with the investigation of certain specific industries and a report covering them is now being prepared.

## To Observe Centennial of Birth of Alfred Bernhard Nobel

THE Institute of Makers of Explosives, New York City, will observe in 1933 the centennial of the birth of Alfred Bernhard Nobel, "the father of high explosives."

The Institute's announcement states: "Nobel was a world renowned genius. He was born in Sweden, October 21, 1833; educated in America and Russia; the founder of the high explosives industry; the first successfully to manufacture and use nitroglycerine as a blasting agent; and the discoverer of dynamite.

"Nobel also invented blasting-gelatine, gelatine-dynamite, and a smokeless powder. He made a fortune in Russian oil and at his death left it for the founding of the Nobel Prize Fund, which has rewarded achievements in science and literature, and the promotion of world peace."


TRADE ACCEPTANCE
STANDARD FORM APPROVED BY THE AMERICAN ACCEPTANCE COUNCIL NEW YORK
No.
(CITY OF DRAWER)
(DATE)
19
ON
(DATE OF MATURITY)
PAY TO THE ORDER OF OURSELVES
DOLLARS ($ )
THE TRANSACTION WHICH GIVES RISE TO THIS INSTRUMENT IS THE PURCHASE OF GOODS BY THE ACCEPTOR FROM THE DRAWER. THE DRAWEE MAY ACCEPT THIS BILL PAYABLE AT ANY BANK, BANKER OR TRUST COMPANY IN THE UNITED STATES WHICH SUCH DRAWEE MAY DESIGNATE.
TO
(NAME OF DRAWEE)
(STREET ADDRESS)
(CITY OF DRAWEE)
ACCEPTED
DATE
PAYABLE AT
(NAME OF BANK)
LOCATION OF BANK
(SIGNATURE OF ACCEPTOR)
BY
(SIGNATURE OF DRAWER)
BY

*Facsimile of standard trade acceptance form*

# The Manufacture of Portland Cement*

## Part V—Cement Composition and Constituents (Continued)

By S. E. Hutton
Consulting Engineer, Seattle, Wash.

### 6. Calculation of the Constituents of a Cement from Its Analysis

Analysis of a cement sample

| | |
|---|---|
| Insoluble | 0.18 |
| $SiO_2$ | 23.72 |
| $Al_2O_3$ | 4.66 |
| $Fe_2O_3$ | 2.14 |
| CaO | 66.11 |
| MgO | 1.45 |
| $SO_3$ | 1.60 |
| Ignition loss | 0.65 |
| Free lime | 0.78 |

| | | |
|---|---|---|
| Lime in: Free lime | | 0.78 |
| $C_4AF$, | $1.4 \times 2.14$ | 3.00 |
| $C_3A$, | $1.65\,(4.66 - 0.64 \times 2.14)$ | 5.43 |
| $CaSO_4$, | $0.70 \times 1.60$ | 1.12 |
| | | 10.33 |
| Lime available for silicates: 66.11 — 10.33 | | 55.78 |
| Lime to convert S to $C_2S$: 23.72 × 1.87 | | 44.36 |
| Lime available for $C_3S$ | | 11.42 |
| Total C and S in silicates: 55.78 + 23.72 | | 79.50 |
| Constituents formed: | | |
| $C_4AF$, | $3.04 \times 2.14$ | 6.5 |
| $C_3A$, | $2.65\,(4.66 - 0.64 \times 2.14)$ | 8.7 |
| $C_3S$ | $4.07 \times 11.42$ | 46.5 |
| $C_2S$, | $79.5 - 46.5$ | 33.0 |
| $CaSO_4$, | $1.7 \times 1.60$ | 2.7 |

In this calculation there is determined, first, the sum of the free lime and the lime required for the formation of $C_4AF$, $C_3A$, and $CaSO_4$ (10.33), which, subtracted from the total lime (66.11), gives the lime available for the formation of silicates (55.78). Subtracting from this the lime required to convert the silica to $C_2S$ (44.36), there is left (11.42) the percentage of lime available to form $C_3S$.

The method of calculating constituents other than $C_2S$ is apparent. That is obtained by subtracting from the total components available for silicates (55.78% of lime and 23.72% of silica) the percentage of $C_3S$ already determined (46.5).

Many charts, slide rules, and tables have been devised to expedite this tedious series of calculations.

### 7. Effect of Variations in Composition on the Constituents of Cement

Recalling the different ratios in which the acid oxide components in cement are combined with lime, and referring to Table I for a few specific analyses, it is clear that the ordinary cement analysis is not a basis from which any but the most skillful cement technologists can guess the percentages of the principal constituents with any great degree of accuracy. However, it is also evident that there may be very considerable variations in analyses and in the proportions of constituents of cements that show good strength, which is a function of fineness as well as of composition of cement. Qualities other than strength may bear a closer relation than strength does to composition.

An increase of 1% in the iron oxide present in cement would increase the tetracalcium alumino ferrite in the cement 3.04%, at the expense of tricalcium aluminate and tricalcium silicate, if the added iron oxide replaced lime only; and such a substitution would effect changes in all three of the other principal constituents, if it replaced in part some of the other components as well.

An increase of 1% in the alumina content of a cement will increase the tricalcium aluminate constituent 2.65%, if the percentage of iron oxide has remained unchanged, at the expense of tricalcium silicate if only lime has been replaced by alumina, but with an increase in tricalcium silicate and a reduction in dicalcium silicate if alumina has replaced only silica.

If other components of a cement are not changed, substituting 1% of lime for 1% of silica will increase the tricalcium silicate about 11%, at the expense of dicalcium silicate.

### Editor's Note

*IN this article the author discusses further the effect of variations in the raw materials or components from which cement is made on the constituents or chemical compounds existing in the cement and the relations between compositions of raw materials and cements.*

*Methods of calculating cement composition from raw material analyses and of calculating the constituents of a cement from its analysis are given.—The Editor.*

It is evident that these relationships are too complicated to admit of accurate guessing at their consequences, and that calculation should be resorted to if reliable information is required. However, it is advisable to point out here the consequences of the incomplete burning of the raw mix—free lime in the clinker, which may cause unsoundness in cement, and a reduction of 4.07% in the potential tricalcium silicate content of the cement for each 1% of free lime.

Unfortunately, cement cannot be made commercially from the simple and separate oxides of the elements present in it, but must be made from cheap natural materials, each of which contains two or more of the elements required. Table II gives analyses of some materials used in cement making. From any cement analysis, it is clear that if a change is to be made in the percentage of one of the oxides present, the percentage of one or more of the other components must also be changed so that the total of all components will be unchanged. From Table II it is evident, because limestone is never pure calcium carbonate, and many limestones as well as all argillaceous materials contain several of the materials required, that it is not usually possible to change the percentage of one of the elements in a cement without changing several others. The advantage of uniformity in raw materials must be apparent.

### 8. The Relations of Compositions of Raw Materials and Cements

Limestones used in cement making are composed partly of silica, alumina, and iron oxide, which in the clinker-burning process combine with a part of the lime in the stone and leave the remainder of it to be combined with the other components in the raw mix. This may be illustrated by using the analyses given in Table II for limestone A and for clay. For convenience it will be assumed that dicalcium silicate and tricalcium silicate are to appear in about equal parts in the cement, in which case the lime required to combine with silica will be 2.27 times the

TABLE II—TYPICAL CEMENT-MAKING MATERIALS

| | $SiO_2$ | $Al_2O_3$ | $Fe_2O_3$ | CaO | MgO | Loss | N.D. |
|---|---|---|---|---|---|---|---|
| Limestone A | 2.28 | 1.42 | 0.70 | 53.01 | 0.94 | 41.65 | ..... |
| Limestone B | 11.48 | 3.20 | 1.56 | 45.47 | 0.69 | 35.80 | 1.80 |
| Cement rock | 13.44 | 4.55 | 2.32 | 41.84 | 1.94 | 32.94 | 2.97 |
| Shale | 67.22 | 17.72 | 3.80 | 3.67 | 0.38 | 3.81 | 3.40 |
| Clay | 59.62 | 17.27 | 6.29 | 3.72 | 3.86 | 5.38 | 3.86 |
| Sand | 73.60 | 13.99 | 3.35 | 2.74 | 0.89 | 1.84 | 3.59 |

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amount of silica in the mix, and the formula developed in discussing the lime required to combine with the acid oxide components of the raw mix will be used.

Lime available for combination with the clay, per 100 lb. of limestone A in the raw mix will be 53.01 — (0.35 × 0.70 + 1.65 × 1.42 + 2.27 × 2.28) = 46.25 lb.

Lime required per 100 lb. of clay used will be 0.35 × 6.29 + 1.65 × 17.27 + 2.27 × 59.62 = 166.044 lb.

In the clay, there is present 3.72 lb. of lime per 100 lb. of clay, so that 162.32 lb. of lime would be required from the limestone, and, consequently, 350.96 lb. (i.e., 100 × 162.32 ÷ 46.25) of limestone would be required to combine with 100 lb. of clay to make 450.96 lb. of dry raw mix. The results of the calculations are summarized in Table III.

TABLE III—CALCULATION OF CEMENT COMPOSITION FROM RAW MATERIAL ANALYSES ($C_3S/C_2S = 1$)

| | 100 parts clay | 350.96 parts rock A | Total | Pct. in raw mix | Approximate analysis Clinker | Cement |
|---|---|---|---|---|---|---|
| $SiO_2$ | 59.62 | 8.00 | 67.62 | 15.00 | 22.59 | 21.74 |
| $Al_2O_3$ | 17.27 | 4.98 | 22.25 | 4.93 | 7.43 | 7.15 |
| $Fe_2O_3$ | 6.29 | 2.46 | 8.75 | 1.94 | 2.92 | 2.81 |
| CaO | 3.72 | 186.04 | 189.76 | 42.08 | 63.38 | 62.22 |
| MgO | 3.86 | 3.30 | 7.16 | 1.59 | 2.39 | 2.30 |
| Loss | 5.38 | 146.17 | 151.55 | 33.61 | ..... | 0.79 |
| $SO_3$ | ..... | ..... | ..... | ..... | ..... | 1.75 |
| N. D. | 3.86 | ..... | 3.86 | 0.85 | 1.28 | 1.23 |
| | 100.00 | 350.95 | 450.95 | 100.00 | 99.99 | 99.99 |

TABLE III-A—CALCULATION OF CEMENT COMPOSITION FROM RAW MATERIAL ANALYSES ($C_3S:C_2S = 3$)

| | 100 parts clay | 395 parts rock A | Total | Pct. in raw mix | Approximate analysis Clinker | Cement |
|---|---|---|---|---|---|---|
| $SiO_2$ | 59.62 | 9.01 | 68.63 | 13.86 | 21.10 | 20.30 |
| $Al_2O_3$ | 17.27 | 5.61 | 22.88 | 4.62 | 7.03 | 6.76 |
| $Fe_2O_3$ | 6.29 | 2.77 | 9.06 | 1.83 | 2.79 | 2.68 |
| CaO | 3.72 | 209.39 | 213.11 | 43.05 | 65.55 | 64.31 |
| MgO | 3.86 | 3.71 | 7.57 | 1.53 | 2.33 | 2.24 |
| Loss | 5.38 | 164.52 | 169.90 | 34.32 | ..... | 0.79 |
| $SO_3$ | ..... | ..... | ..... | ..... | ..... | 1.75 |
| N. D. | 3.86 | ..... | 3.86 | 0.78 | 1.19 | 1.15 |
| | 100.00 | 395.01 | 495.01 | 99.99 | 99.99 | 99.98 |

By adding together the percentages of each component, such as $SiO_2$, in 100 parts of the clay and 350.96 parts of the limestone, there is obtained the number of parts of each component in the 450.96 parts of resulting dry raw mix, as given in the third column of Table III. By multiplying each figure in that column by the reciprocal of 450.96, which with a calculating machine is simpler than making many divisions by 450.96, the percentage of each component in the raw mix is found, as given in the fourth column of Table III.

In converting the raw mix to clinker, the ignition loss occurs, so only 66.39% (100 — 33.61) of the raw mix will appear in the clinker (assuming that there is no gain or loss of material in the kiln), so each of the oxide percentages in column four is multiplied by the reciprocal of 0.6615 (1.5117) to obtain the percentage of each oxide in the clinker.

Gypsum is ground with clinker in order to control the setting time of the resulting cement. The analysis of the cement will differ from that of the clinker by the addition of sulphur trioxide ($SO_3$), lime (CaO), and water, which will appear in the ignition loss. If the formula for gypsum ($CaSO_4 \cdot 2H_2O$) is broken up into such parts, proper allowances for the addition of gypsum can be made in the calculated cement analysis.

The molecular weight of gypsum is 172.13, of $SO_3$ is 80.06, of lime is 56.07, and of water, 18.00. If the cement is to contain 1.75% of $SO_3$, and it is present in gypsum (not in part as anhydrite, or plaster of paris), there will be present also in the gypsum 1.23% of lime (1.75 × 56.07 ÷ 80.06), and 0.79% of water (1.75 × 36 ÷ 80.06), and the gypsum will compose 3.77% (1.75 × 172.13 ÷ 80.06) of the cement, leaving 96.23% to be made up of clinker. In the last column is the analysis of 96.23% of clinker and 3.77% of gypsum. Analyses of raw materials, cement and clinker are not sufficiently precise to warrant dealing with gypsum in such detail, and in most cases it is permissible to add 1.75% of $SO_3$ and 1.25% of lime to 97% of clinker to determine the approximate composition of cement. In modern long grinding mills, gypsum is partially dehydrated.

For purposes of comparison, Table III-A is added, showing the results of combining clay and limestone A from Table II in such ratio as to cause tricalcium silicate and dicalcium silicate to appear in the ratio of about 3 to 1 in the resulting cement. For such a combination, the lime available for the formation of the two silicates must be 2.51 times the silica in the mix.

Lime available for combination with clay, per 100 lb. of limestone A, is: 53.01 — (0.35 × 0.70 + 1.65 × 1.42 + 2.51 × 2.28) = 44.70 lb.

Lime required per 100 lb. of clay used is:

| | |
|---|---|
| 0.35 × 6.29 + 1.65 × 17.27 + 2.51 × 59.62 = | 180.34 |
| Lime in the clay | 3.72 |
| Lime required from limestone | 176.62 |

176.62 ÷ 44.70 = 3.95, the number of parts of limestone required for each part of clay used in the raw mix.

Using the same raw materials, in the ratio 4.04 parts of rock to 1 of clay, the lime content of the cement will be only about 0.9% greater and the silica content will be about 0.07% less, but the ratio of tricalcium silicate to dicalcium silicate will be 4 to 1, and good burning will be more difficult. This example emphasizes the importance of close control and uniform materials.

In calculations made so far, we have disregarded the fact that clinker always contains a small percentage of free lime, which means that there is actually in the clinker a little less tricalcium silicate than such calculations would indicate. Later, free lime will be taken into account.

Analyses of cements and raw materials are not absolutely accurate, and variations occur in the compositions of raw materials, but absolute uniformity is neither necessary nor possible. Some of the raw mix is lost as kiln dust, and some material (roughly 2.5 to 5% of the raw mix) is gained from ash if coal is used in burning. Consequently, calculation of clinker composition from the analyses of raw materials (which should include ash in coal-burning plants) is to be regarded as an approximation which is to be adjusted by comparing clinker analyses with calculated compositions.

A brief bibliography on the constitution of portland cement clinker, etc.:

1. "A Digest of the Literature on the Constitution of Portland Cement Clinker," by R. H. Bogue, Paper No. 3 of the Portland Cement Association Fellowship at the Bureau of Standards, *Concrete* (C.M.S.), July, 1926, to February, 1927. (A comprehensive bibliography is included.)

2. "Calculations of Compounds in Portland Cement," by R. H. Bogue, Paper No. 21 of the P. C. A. Fellowship at the Bureau of Standards, ROCK PRODUCTS, **32**, No. 23 (1929) 47.

3. "The Constitution of Cement Clinker," by G. A. Rankin, *J. Ind. Eng. Chem.*, June, 1915.

4. "The Constitution of Portland Cement," by P. H. Bates, *Concrete-Cement Age* (C.M.S.), **2** (1913) 3.

5. "The X-Ray Method Applied to a Study of the Constitution of Portland Cement," by L. T. Brownmiller and R. H. Bogue, Paper No. 24 of the P. C. A. Fellowship at the Bureau of Standards, *Am. Jl. Sc.*, October, 1930.

(*To be continued*)

## On Low-Cost Roads

A BULLETIN, No. 27, has been published on Low-Cost Roads by the American Road Builders' Association, Washington, D. C. This booklet contains a number of committee reports presented at the Detroit meeting of the association. The report includes a discussion of construction machinery, road types, recent practical developments in design and construction, and data on the use of various bituminous materials for this use.

# Opportunities for Using Indicating and Recording Control Instruments in the Rock Products Industries

## Part IX—Instrumentation in the Glass Industry

By James R. Withrow*
Chairman, the Chemical Engineering Department, Ohio State University

THE previous articles have shown the importance of instrumentation to the development of the automobile, petroleum and chemical industries. In this article will be shown the importance of instrumentation to the glass industry which is a high temperature industry like lime and cement manufacture. The glass industry is using more control instruments than ever before, particularly pyrometers.

The ancients could make as good glass as we do but lacked the skill to control uniformity and duplicate quality so vital in large scale production. Today, through automatic control of temperatures, the human element is eliminated and the former irregularities avoided. The tanks, pot furnaces, pot heating kilns, lehrs and gas producers are equipped with indicating and recording pyrometers. The indicating pyrometers tell the operators the temperature of the different heating units at any time. They don't have to guess and there is no waste of fuel. The recording pyrometers enable the management to check up on both men and equipment.

The introduction of continuous tank furnaces instead of pot furnaces to produce glass more economically and the use of machines for making bottles, etc., instead of the old style blowing method, was a distinct revolution in glass making.

Before actually melting glass in tanks or pots these fire clay containers must be properly heated as their life depends largely upon this heating up process. The tank consists of a great mass of fire clay and unless the temperature is brought up very gradually strains will be set up which will break the expensive tank block. Also defective glass may be traced directly to improper heating.

### *Melting Troubles*

There are two distinct melting chambers in most tanks, melting and fining; and the melting chamber can also be divided into a sintering and melting portion. If the sintering part becomes too hot, lumps are liable to form which may cause poor glass. If the melting chamber becomes too hot it may burn the life out of the glass, while uniformity of temperature in the fining chamber and feeder reservoirs has everything to do with the actual machine production.

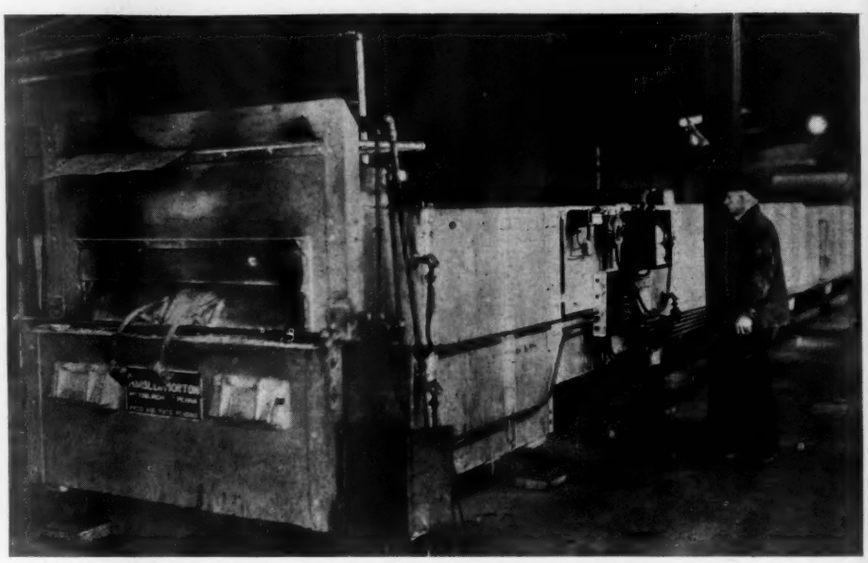


***Fig. 46. Indicating and recording pyrometers on a glass annealing lehr***

Improper melting conditions will cause cords, excessive seed, poor color and glass which is stiff. A lower temperature is usually found in the working end while the highest temperature is in the melting end. A low temperature in the melting end is almost sure to give seedy glass while too low a temperature in the fining chamber is apt to produce streaky or cordy glass. Thus, the control of temperature throughout a tank has everything to do with the quality and quantity of glass obtained. Fifteen degrees one way or another will in some cases cause serious loss in production.

It is desirable that the raw material from which glass is made should be brought to the melting point as quickly as possible and at the same time proper regard must be maintained for the furnace linings, and the temperature after melting should not be allowed to become excessive. Fluidity depends to a great extent upon temperature and this factor has a great deal to do with the proper forming of the products to be made from the glass. Bottles are made on automatic machines. Each mold is held in place to receive glass from the furnace for a predetermined period of time. If the viscosity of the glass is right the mold will be properly filled, but if the glass is too fluid the walls of the bottle will be thin in some places and thick in others. A low pot temperature means thin bottoms, while a high temperature means thin shoulders. Hence the temperature must be maintained at a correct point for good results.

### *Plate Glass Annealing*

The principal improvement in plate-glass making in America is the annealing lehr. This lehr is about 200 ft. long, starting from the casting table as a continuous series of five kilns, and then continuing in the form of the usual rod lehr, as used in window-glass factories. These five stations rest at the outset on a solid clay hearth; they are electrically lighted and the different degrees of heat are readily maintained by control of the amount of heating current by instrumentation.

The object of annealing is to remove the strains which are already set up in the ware or which would be set up if it were cooled

*The author is indebted to J. G. Callinan, Dr. Wei Yang and the Engineering Experiment Station of Ohio State University for assistance in the preparation of this paper.

rapidly in the outside air. The strains are removed by heating the glass until it is softened enough to relieve the strains but not enough to cause the ware to lose its shape, and this point is called the annealing temperature. This is not a fixed point since proper annealing depends upon both time and temperature. The lowest temperature at which glass may be annealed may require several days time for the complete elimination of strain and is usually referred to as the lower annealing temperature. At the highest temperature to which the ware can be safely brought the strain can often be removed in a few minutes. This is referred to as the upper annealing temperature. The difference between them makes a great difference in cost.

At the upper annealing temperature the strain is rapidly removed, but successful annealing also depends upon cooling the glass in such a manner as to prevent the reappearance of the strain. The safe rate of cooling varies considerably in the different stages of the annealing process. It is of course more economical to move the ware through the lehr as fast as possible due to increased production without increase in equipment. It is believed by some that in the upper part of the annealing range cooling can be fairly rapid. Cooling may also be carried on rapidly below the lower annealing point as the glass is then completely set and is rigid enough to resist forces which tend to cause strain. The point of greatest danger is the lowest part of the annealing range where stiffening of the glass is rapidly taking place. As the time-temperature annealing curve for glass is not a straight line, efficient annealing cannot be obtained by allowing the ware to cool at an even rate. Therefore, manual control of cooling is impossible. Some arrangement must be resorted to for varying the heat in different parts of the lehr according to a predetermined annealing schedule. This calls for close and accurate control of the temperature and can be accomplished only by automatic temperature control.

On the continuous type of tank and lehr the glass sheet is formed between two water cooled rollers and passes into a continuous roller lehr. It is important to control the temperature of the rolls which form the sheet and for this purpose a special thermo-electric element is placed against the surface of each roll. This is a base-metal couple enclosed in a special shoe which fits against the roll. The lehr is equipped with 35 to 40 base-metal thermocouples arranged so as to show the temperature on the top side of the plate at each edge and at the center. They are inserted through the crown of the lehr and extended to within a few inches of the glass surface. Through the annealing range the couples are spaced about 5 ft. apart and this spacing is increased as the glass cools below 900 deg. F. The length of the annealing range is increased or decreased according to the thickness of the glass and its speed through the lehr. The glass must not be cooled too quickly, yet undue delay means increased overhead and operating expense. Thus proper temperature control prevents meltage, secures properly burned in color and insures perfect annealing. Fig. 46 (courtesy Brown Instrument Co.) shows the use of pyrometers, both indicating and recording, together with a rotary switch, on an annealing lehr. The rotary switch and indicating pyrometer makes it easy to read all the temperatures by just rotating the switch.

Fig. 47 (courtesy Brown Instrument Co.) shows three pyrometers, one recording temperature of gas producers, one the temperature of the annealing ovens and the third the temperature of the glass furnace.

### *Plate Glass Melting*

The fusing of the silica and other materials requires very high temperatures which unless well controlled are apt to break the pot holding the material. On the other hand, if the temperatures are too low the quality of the glass will be impaired. To guard against such contingencies recording pyrometers must be used.

At one plant the furnaces are fired by producer gas and each one contains 20 melting pots, 54 in. in diameter. On the average, 27 hours are required for each melt. The pyrometers indicate and record the temperatures continuously for each furnace and every 24 hours the record sheet is torn off, dated and filed for reference.

The temperatures were formerly gaged by observing the melt and the viscosity but it was rarely possible for even the most expert men to determine the true temperature within 200 deg. F. Not infrequently a melting pot was cracked with the loss of the pot and the melt, due to allowing the temperature to become too high. This was injurious to the furnace and involved an appreciable loss in fuel gas. These losses have been eliminated by the use of pyrometers, and it is estimated that the instruments repay their original cost each year.

### *Window Glass Manufacture*

Fig. 48 illustrates the use of pyrometers in a modern machine drawn window glass plant to record and indicate the temperatures of the melting end of the glass tanks.

Fig. 49 also illustrates the pyrometer installation at a window glass plant. These instruments are used to indicate and record the temperatures of water cooled thermocouples on the working end of the glass tanks, drawing pits and throats.

As a result of instrumentation in the manufacturing of glass, one company reports an increase in production of 25%; another reports an annual saving of $6000; still another plant reported that the pyrometers cost only 42c per day per instrument.

A modern drawn window glass plant usually operates two continuous, regenerative melting tanks, each of about 1000 tons capacity, designed to melt with either natural or producer gas as a fuel. Each tank is in operation about 14 to 18 months, twenty-four hours per day, every day of the month. At the end of the period the tank is cooled off and repairs made.

Sixty tons of raw materials are melted in each tank every twenty-four hours. Each tank is connected to a drawing tank equipped with six sheet glass machines. The raw materials are transformed into molten glass in the melting tank and this flows into the

***Fig. 47. Three recording pyrometers at a glass plant, recording temperatures of gas producers, annealing ovens and glass furnace***

drawing tank, passes upward through a slot in a floating clay block and is drawn up through the machines as a continuous flat sheet of glass. This sheet, 60 in. wide, is drawn at speeds varying from 8 to 30 in. per min., the exact speed depending upon the strength (thickness) of glass drawn.

The glass is thoroughly annealed during its passage up through the machines and upon emerging at the top is cut off into large sheets. The drawing process is such that the sheets have rounded edges, called bulb-edges, which are cut from the sheet and later sold for shelving purposes. The sheet, stripped of its edges, is placed on a specially designed glass carrier suspended from an overhead monorail. The carrier, loaded with twenty sheets of glass, is lowered into a tank containing a hot dilute solution of muriatic acid, allowed to remain for only a second, then removed and placed over a source of hot air in order to thoroughly dry the sheets. After being dried, the sheets are conveyed to the cutting room where they are cut into the various commercial sizes and qualities.

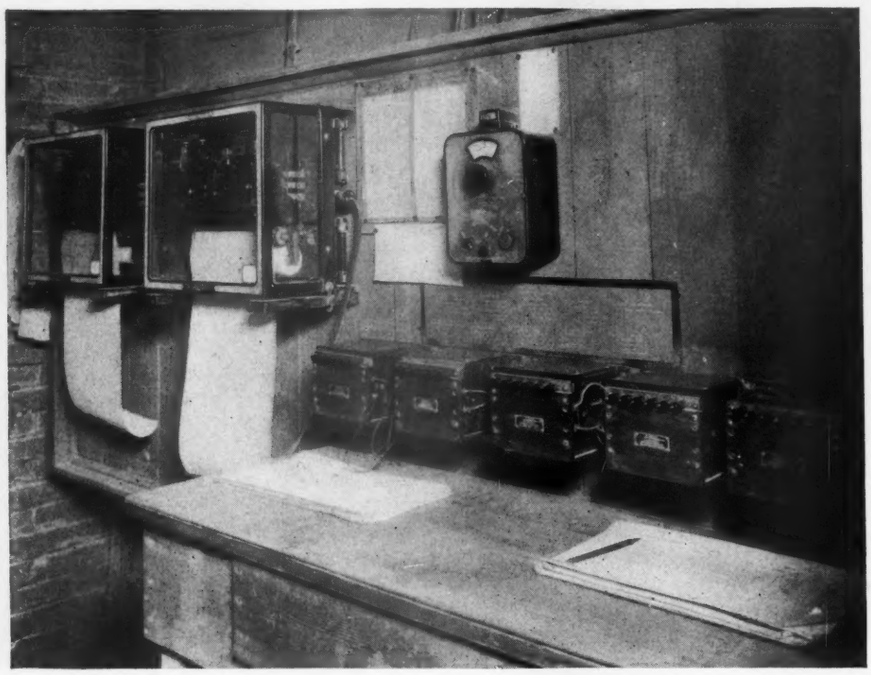


***Fig. 48. Pyrometer installation to record and indicate temperature of melting end of glass tanks in a machine drawn window glass plant***

Temperature control starts with the manufacture of the producer gas. A recording thermometer gives the temperature of the steam-air blast and a recording pyrometer records the temperature of the gas at the off-take from the producer.

The next point of control is the melting tank. Pyrometers indicate the temperatures of the gas and air in the flues to and from the tank, also the mixed waste products in the stack flue. Three pyrometers in the crown of the melting tank record the temperatures at the melting end, the refining zone and the conditioning zone. Pyrometers in the side walls indicate the degree of uniformity of the body heat of the molten glass. A protected thermocouple immersed in the glass flowing through the connecting channel to the drawing tank is the final measure of melting tank performance.

In front of every machine there is a heating or conditioning pit for the glass. Protected thermocouples immersed in the glass in each pit enable the operator to make the final adjustment in temperature and maintain that condition which is necessary for maximum production of glass of a quality to meet the market demand. The drawing machine proper is an annealing lehr utilizing only the body heat of the glass but capable of adjustment of temperature by manipulation of dampers. A thermocouple in the machines gives the operator the facts required to enable him to make adjustments before breakage of glass or other trouble occurs. The final points of temperature control are the indicating thermometers immersed in each of the two dip tanks. With these the acid solutions can be kept at set temperatures to give the desired results from the dipping operation without keeping the solution too hot, thereby saving steam and conserving the life of the tank.

Some of the benefits resulting from such temperature control are:

1. No waste of fuel because of running at excess temperatures or having to bring up to temperature a tank that has been allowed to cool off a bit.

2. No unnecessary wear and tear on the tank because of operating at excess temperatures.

3. Increased production through a higher drawing speed by maintaining a desirable temperature, no time lost in having to regain this condition and less breakage in the machines.

4. More uniform quality and higher average quality.

In a chemical engineering process the important thing is the accurate completion of some change in the raw materials. Pushing the change past completion or failing to reach completion lowers production or quality and frequently both. In any change there is one combination of pressure, temperature and concentration that will give maximum quantity of production of a given quality. Over or under application of one or all of the variables results in a loss.

In most processes where change is involved temperature is a fundamental factor, and the only way to maintain the right temperature is by the use of instruments—pyrometers in high temperature work. As in other processes, temperature is the all important variable in the manufacture of glass. *It must be measured, not estimated.* In estimating glass temperatures the judgment of men will vary between themselves and in themselves. Difference of judgment between men is to be expected and frequently when one agrees with another as to a temperature by estimation by eye it is a matter of policy. Ability of individuals to judge closely varies with the time of day. At night the furnaces look hotter by comparison. Hot midsummer days tends to make a furnace look hotter than when judged during the winter. Again, the particular occupation of the observer just prior to estimating, especially if the occupation causes eye-strain, affects his judgment. And, finally, with the passing of years the eyes change, experience accumulates and the judgment may become better or worse. In fact, *estimation of temperatures by eye is absolutely not dependable in these days of close tolerances.* Before the introduction of machines the worker handled the glass with tools. He worked and *felt* the glass and this was an important factor in his estimation. The machines themselves have no senses. We supplement them with pyrometers and thus replace the man skill.

For best results the glass making process is dependent upon a knowledge of the temperatures involved. As in other processes there is just one combination of temperature, pressure and concentration for the maximum production of molten glass of a certain quality with a minimum consumption of fuel and a minimum amount of wear on the tank structure. Concentration (or batch) and pressure are fairly well fixed. Temperature is the factor that most easily departs from the value desired and is the factor most easily, economically and quickly varied when a change is desired.

In the drawing operation itself there are two kinds of changes involved, chemical and physical, and temperature is the dominating factor in both. If the glass in the drawing tank is too hot, production (speed

*Fig. 49. Pyrometer installation at a window glass plant*

of draw) is slowed up and breakage of glass in the machines is encountered. If too cold the glass will devitrify, that is, one or more of its components will crystallize out, with disastrous results. Thus for the most profitable operation the temperature must be held high enough to avoid the devitrification and low enough to avoid breakage and to get high drawing speed. The closer the lower temperature limit can be safely and consistently approached the more profitable the operation will be. Pyrometers are the tools the engineer uses to attain this condition.

***Automatic Blowing of Lamp Bulbs***

The advantage of instrumentation is well illustrated by its use in manufacture of lamp bulbs at one of the large plants where the entire process from the mixing of the batch to the annealing of the finished light bulb is done under instrumental control. The plant normally uses more than 52,000 lb. of glass in the manufacture of more than a half million electric light bulbs every day. This is a continuous operation carried out in reverberatory type glass tanks. Recording pyrometers give a continuous record of temperature of the molten glass. The rate of flow of molten glass from the glass tank is governed by the level of the mass in the tank. If this rate is too fast the finished light bulbs will be too thick, if too slow they will be too thin. So important is this rate, in the control of bulb uniformity, that the level of the molten mass in the tank is controlled with the aid of a telescopic sight level with cross hairs.

After blowing in automatic molding machines which have a daily capacity of 120,000 bulbs each and are of turret type and blow simultaneously on three levels, the bulbs are annealed to relieve internal strain. The properties of the bulbs depend not only on their composition, but equally on their annealing. They must be annealed, by gradual cooling under close control as to time and temperature so that they will be resistant to sudden temperature changes. This delicate operation is only satisfactorily carried out under control by instrumentation.

The importance of instrumentation can not be over emphasized in the case of the glass industry. It gives exact regulation of melting tanks temperature, effects a marked improvement in the product and quickens the rate of production. The annealing and heat treatment of glass is one that also needs extensive instrumentation. Proper annealing, with close temperature control, decreases the possibility of breakage and especially with optical instruments, prevents serious warping.

With automatic control instruments, the human element is eliminated and correct temperature insured at all times without the necessity of hand adjustment. Without instrumentation modern mass production of plate glass, machine window glass, machine blown glass ware and electric light bulbs would not be possible.

*(To be continued)*

## Solid Carbon Dioxide in Industrial Refrigeration

THE use of solid carbon dioxide in industrial refrigeration, apart from its rapidly growing use in the preservation of perishable foodstuffs, is discussed in an article by D. H. Killeffer in the June issue of *Industrial and Engineering Chemistry*.

It is stated that while the cost of refrigeration by this method is higher than mechanical refrigeration for ordinary temperatures, it has advantages where very low temperatures are required or where the operation is intermittent or on a small scale. Temperatures down to —165 deg. F. can be obtained, which would otherwise require expensive tandem refrigerating installations. Particularly in the case of intermittent operations requiring very low temperatures, as in the manufacture of perfumes, it has been found much less expensive than to install mechanical refrigerating machinery.

Where portability is a factor it has also been found advantageous. This is illustrated by the method of handling aluminum alloy rivets in some shops fabricating such materials. Aluminum alloy rivets require careful annealing to insure their softness when driven and even ordinary temperatures will harden them in the short space of a half-hour. To avoid having to re-anneal them, each riveter has a small box refrigerated by solid carbon dioxide and the rivets are kept in this.

It is stated that solid carbon dioxide can now be supplied throughout the country. Its properties are given as follows:

| | |
|---|---|
| Density: | 90 lb. per. cu. ft. |
| Subliming temperature (at one atmosphere) | —109.6 deg. F. |
| Latent heat (at subliming temperature) | 246 B.t.u. per lb. |
| Specific heat of gas | .193 |

## Sugar in Lime Mortar

CONSIDERABLE publicity has been given an abstract of a paper read at the recent annual meeting of the American Chemical Society telling of interesting results from the use of a sugar solution in mixing lime mortars, based on research work at the Mellon Institute, Pittsburgh, Penn. Answering an inquiry on this subject the Building Research Station of Great Britain replies:

"The use of sugar in lime mortar is a very old practice. In Building Research Special Report No. 9, 1927, attention is drawn to the traditional use of sugar (jaghary) in India for this purpose, and the peptizing action of sugar has long been utilized in the preparation of lime washes.

"There are instances where sugar has been used in lime mortars in the United States of America, but the limes used there are almost exclusively 'fat' high calcium or high magnesium limes, with no appreciable strength of their own, or hydraulic set. Any useful strength attained by a mortar made with such limes, apart from merely drying out, must be due to carbonation. Strength tests made without due reference to this factor are, therefore, meaningness. It is possible that the sugar, by forming a calcium saccharate solution in water, may accelerate the rate of carbonation, but we have no experimental evidence that this occurs. In the same way, improved workability as a result of this peptizing action might be obtained, but this again is a mere surmise.

"It is likely that the chief point in using sugar in a lime mortar in our climate is that of frost resistance, since the freezing point of the gaging water would be slightly lower; this might just provide the necessary protection against a disastrous freezing and expansion in a critical case."

# Production of Aggregates from River Gravels in the Plains Region

## Part III—Dredging Methods and Power

By John H. Ruckman
M.S., Assoc. M., A.S.M.E., Topeka, Kan.

AS STATED in a previous installment the centrifugal pump has practically displaced all other methods of dredging sand and gravels in the Central Plains region. This situation has come about largely as a result of the great capacity which can be obtained with this device, in return for a moderate outlay in capital, and also due to the fact that the only wasted energy—that used in lifting and transporting water—is generally necessary in any case due to the necessity of washing and hydraulicly sorting the product. For example: A 10-in. pump working against a head of 100 ft. and pumping clear water, will deliver about 3,000 gal. per min. (g.p.m.). Pumping sand laden water the efficiency is much lower and the actual discharge is likely to be more nearly 2,000 gal. or some 270 cu. ft. per min. If the water and sand mixture is 10% solids, the resulting production is 60 cu. yd. per hour. Under favorable conditions this production may be more than doubled.

The cleansing effect of the water pumped is also worth considering, for it is seldom necessary to add water for washing or classifying purposes. The writer recently visited a plant using dry excavating methods in which washing and classification required the full output of an 8-in. pump working against 120 ft. of head, for washing alone.

The cost of pumps varies with the make and design but a 10-in. pump of the less expensive types can be purchased for as low as $1,500 (in 1931). A second-hand motor to drive it can be obtained for about the same price, while a barge complete will cost about $3,000. It will be seen that the centrifugal pump offers a possible capacity of some 1,500 to 3,000 cu. yd. per 24 hours in return for an investment, including pontoons, piping and shore structures until recently seldom exceeding $10,000.

The development of the deeper "blue" gravels, and some other factors have somewhat altered the situation. It has been necessary to add "ladder diggers," which have greatly increased the first cost of the river equipment. The great excess of water discharged at the shore end has also caused trouble. Indeed labor cost is often high, due to the necessity of calking freight cars with burlap to prevent the material from being washed right through. This situation has resulted in a growing demand for dry handling on shore, and may ultimately result in altered methods of dredging. For the time being, however, the centrifugal pump remains the one method in actual successful operation.

### Editors' Note

***THE AUTHOR discusses the type of dredge pump in common use, and deplores the lack of available data regarding performances and efficiencies.***

***Power for pumping is discussed in detail and a comparative analysis made between purchased electric power and internal combustion motors. The conclusion is that with the development of lighter, cheaper operating, internal combustion motors power costs in the future will be materially lowered.—The Editors.***

### *Type of Pump Used*

The pumps in use are practically all single-suction, single-stage units with moderate sized impellors. Practically all the impellors are of manganese steel, as are the vast majority of the side plates. Some of the latest installations have manganese-steel liners. Some of the more experienced pump manufacturers have recently brought out pumps in which the water passages have been gently curved to accord with sound hydro-dynamic theory and with actual tests made by United States Government dredges on the Mississippi.

It seems most unfortunate that so few tests on dredge pumps have ever been recorded. These newly designed pumps should have and undoubtedly do have a higher efficiency than the old models. The question then arises, how much? It would appear that for at least ten years certain types of pumps have been manufactured and sold all over the United States without so much as a single test to determine under operating conditions, either efficiency or characteristic performance curves. Another very important point regarding which no manufacturer seems desirous of expressing an opinion is, what effect wear will have on the efficiency and capacity of the pumps. Both, at constant speed, are reduced; but how much?

This complete lack of information has proved most annoying to engineers and operators. For instance, let us assume a 10-in. pipe line 600 ft. long and rising 60 ft. above the water and 10 ft. of head lost due to velocity imparted to the water and bends. Using the tables published by the Morris Machine Works (which are as reliable as any), and assuming a flow of 2,500 g.p.m., the loss due to friction works out very close to 40 ft., and the total head is 110 ft. If the water and sand weigh 70 lb. per cu. ft., the net power required to force it through the pipe is 79 hp. Allowing for overloads, pump efficiency, and wear of the pump it would seem that a 200-hp. motor should be ample. Yet as a matter of fact, 300-hp. is the size generally used for driving 10-in. pumps on the Kansas River, while in Texas the writer has seen pumps of this type connected to 400 hp. motors!

The question may be properly asked: Is this the fault of the pumps, or of "free engineering service" provided by the power companies which sold the motors? That it is not entirely the latter has been demonstrated to the writer by the fact that it is difficult to tighten belt drives sufficiently to turn some of the pumps at 600 r.p.m., corresponding to a head of 100 ft. For the particular pump in question the makers' tables call for less than 200 hp., and the pump is perhaps over-powered. On the other hand, the difficulty of keeping the belts in shape strongly suggests too much torque and perhaps too much speed in an attempt to get rated capacity. Engineers for certain power companies have expressed their belief to the writer that the pumps actually in use on the Kansas River are about 40% efficient. On this basis, most of them are still somewhat over-powered, but it seems highly probable to the writer that this is actually the usual efficiency, particularly as most of them are working against heads higher than those for which they were designed.

The head against which any one pump may be operating can always be reduced by placing a "booster" in series, and if excess head is all that is wrong the efficiency should be improved by so doing. The investment is doubled, however, when this is done and the question remains, whether or not it is cheaper to do so or to continue to operate at reduced capacity through one unit. Certain makers are now giving attention to this

matter, and it is to their advantage to do so for many plants are now operating at reduced capacity due to the use of long pipe lines which should be operating with two pumps.

### Motors for Pumps

Something has already been said of motors. Since most of the pumps run at from 500 to 600 r.p.m., many of the earlier electric motors in use were 585 r.p.m. types. These are unnecessarily heavy and expensive. The 860-r.p.m. motor is perfectly satisfactory, and the 1,150-r.p.m. type can be used up to 150 hp. providing it is fitted with proper drives. For the largest sizes and for 1,740-r.p.m. types silent chains or gearing are necessary, and few if any installations of this type have been made. In a 300-hp. unit, the saving in price effected by using a 1,740-r.p.m. unit instead of one of 585 r.p.m. is slight due to the necessity of installing a positive drive, but the weight saved is nearly 10,000 lb., which in turn permits a lighter and less expensive barge.

A rather curious point which has been noted is the general installation of wound-rotor, variable-speed motors and the uses made of them. The wound rotor has a distinct advantage over the squirrel cage in starting current, and the variable-speed feature should permit constant capacity against varying friction heads. Although the installation is generally made to provide this feature, it is seldom used. The decrease in efficiency and amount of wasted energy involved in speed control by varying the resistance of a wound rotor is not serious. Indeed for the same velocity of fluid in the discharge line the lost energy is about constant and a motor which will be 85% efficient at 585 r.p.m. will be about 82% efficient at 470 r.p.m.

On the other hand, if a pump has been moving water against 100 ft. of head and the head is suddenly reduced to 81 ft. (corresponding to a 10% reduction in speed), and if the pump speed remains constant, more water will flow until the friction head again restores the 100-ft. head. On a 600-ft. line of 8-in. pipe with a velocity of 12 ft. per sec., the friction head is about 40 ft. To increase this by 19 ft. will require the velocity to reach about 15 ft. per sec., and the quantity of water passing will show an increase of 25%. Due to the fact, however, that the pump is now throwing water against the same total head as previously, 25% more power is needed. Had the speed of the pump been controlled it would be throwing the same amount of water as was originally handled with about 81% of the original power. If the cost of power for pumping under the original condition were 4c per cu. yd., it would drop to 3.2c with reduced speed, or perhaps even lower due to increased efficiency of the pump. By holding the speed constant the cost of power per million *gallons* pumped remains about constant, but the increased velocity tends to increase the percent. of solids, and hence lowers the cost per cubic yard. Wear is increased, but the capacity of the plant is increased and hence fixed and labor charges tend to drop. Because of these two last factors the motors are generally held at full speed and the pumps worked to utmost capacity. This system undoubtedly pays in times of good business, but is not necessarily wise when plants are suffering somewhat from intermittent operation.

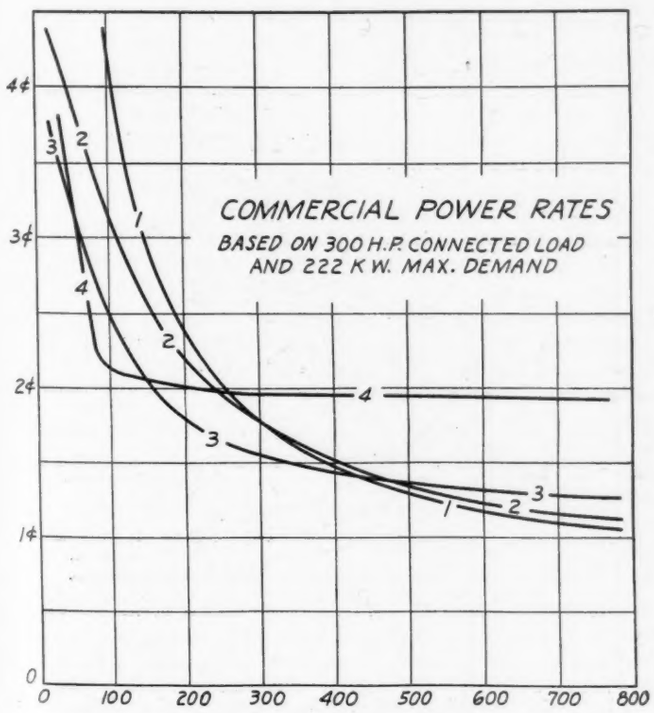



***Fig. 1. Comparison of different power rates for various hours of operation per month***

### Cost of Power

As has been stated, the original reason for adopting the centrifugal pump as a means of excavation seems to have been its large capacity compared with its cost. For a similar reason electric motors were generally selected as the drive. As the business has become more stable, the economy of this type of drive has been questioned.

The cost of purchased power in the area under discussion varies somewhat, but the rates are all developed on a more or less similar system involving a charge for connection based on demand or possible demand, a minimum charge supposed to cover incidentals connected with administration, and a charge for energy used, the last two being frequently combined as a variable "energy charge." As a result the cost of power varies somewhat according to the amount used.

In Fig. 1 are shown some of the rates now prevalent (in 1931), based on a 300-hp. (222-kw.) installation at various hours of operation per month. Curve No. 1 represents the rate in a large city with an excellent central station. Curve No. 2 closely approximates the rates in two cities, one smaller and one larger than No. 1. No. 3 is offered in a community of 20,000 population while No. 4 represents the ordinary type in a small town where an inexpensve and not particularly efficient power plant provides the current. Of rates shown Nos. 1 and 3 carry serious minimum charges, while No. 3 has only a very light charge when the plant is entirely shut down.

Most sand dredging operations vary in activity from a practical shut-down in January to a maximum of from 300 to 400 hours of operation per month. The plants nearest the larger cities generally enjoy the steadiest operation, but at the end of the year the total bill for power will be just about what it would be per month on an operating basis of from 150 to 200 hours. It will be noted that in the above curves, if a plant operating on curve No. 4 worked 100 hours a month its energy will cost 2.1c per kw.h. If a plant on the rate represented by curve No. 3 operates 150 hours the rate is 2.05c, while in the larger cities 200 hours' operation results in charges of 2.18c. and 2.37c. under rates Nos. 2 and 1, respectively.

It is interesting to note that in the districts served by rates Nos. 3 and 4 every pump now operating is electrically driven. In the smaller city served by rate No. 2 this is also true, but there are several Diesel-engine-operated dredges in the larger city using the same rate. In the district served by No. 1, independent power is the rule rather than the exception, a condition which suggests that a charge of 2c. per kw.h. as an average is more or less critical.

The question may naturally be asked: "Can this rate be bettered by the use of internal combustion motors?" The answer is that it *can* be bettered, but that in many cases the change does not produce the results hoped for. The electric motor is a standardized product. From time to time slight changes are made in winding or material, but these affect operation but little. Electric motors of various makes, new or second-hand, perform very much alike from an operating standpoint. Breakdowns are very rare, and are caused as a rule only by overloading or flagrant lack of lubrication. The internal combustion motor, on the other hand, is still being improved. Changes are being made continuously, there is no standardized design; and among the various

models offered there are startling differences in upkeep cost and reliability. All internal combustion motors require some supervison, and constant lubrication must be insured. If through carelessness an electric motor is ruined, the loss may amount to $10 per hp., but if a Diesel engine is allowed to wreck itself, the damage may reach $100 per hp.

As a result, the use of internal combustion engines requires better and more intelligent supervision, and it requires better engineering and more initial capital outlay than electrical equipment. For use on barges it does not require any addition to the crew, since the pump operator can easily watch the lubrication and keep constantly in touch with the "feel" of the engine while handling his suction pipe. For the older "heavy" type of Diesels somewhat larger barges are required, but the difference in cost is seldom more than the price of an electric motor, and as a result the cost of power developed by the internal combustion motor can be directly compared with the cost of purchased power.

### *Comparison of Power Costs, Diesel and Electric*

When one starts to compare cost of internal combustion motor operation with that of purchased power, there are three serious difficulties involved. These are: First, there is little published information as to average repair costs on engines of this type; second, there is very honest difference of opinion as to rate of depreciation. Finally, there is no unanimity of opinion as to what the money invested in an engine would be worth to the concern if invested in some other part of the plant.

Maintenance costs vary. The writer has rather detailed reports on some one hundred units installed between the years 1920 and 1926, which show that the average cost of repairs and maintenance came to about 0.2c. per kw.h., or about 30c. per hp. capacity per month (at 200 hours average operation).

For heavy Diesels it is ordinarily customary to assume that the bed and frame will last 20 years (actually they do not wear out and this charge represents obsolescence only), crank and governor 10 years, cylinder linings 6 years, wrist-pin bearings 5 years, wrist-pin valves and gears 3 years, and piston rings 1 year. On this basis annual depreciation is figured as 5% of the first cost plus 33%, or more simply 6.67% of the first cost. If the installation cost $90 per hp. capacity, this figure reduces to 50c. per hp. installed per month. It will be seen at once that where 30c. per hp. per month is being spent on replacements and repairs, true depreciation is liable to be less than the combined figure represented by these figures. The $90 per hp. is also a high figure for present prices. Accordingly the writer customarily assumes 75c. per month per installed hp. as a fair charge for depreciation, repairs and maintenance.

Insurance and taxes vary, but are customarily taken at 2% per year or at $90 per hp., 15c. per month.

Interest on capital invested, however, is quite another matter. Where a concern, as is frequently the case in the East, possesses a goodly surplus, this surplus may be earning only 4 or 5%. In the district under discussion, there are very few concerns which possess a surplus, banks are unaccustomed to financing industrial enterprises, and it is often necessary to "carry" contractors for long periods. Under these circumstances the writer is inclined to put the value of such capital at 12%, or 90c. per hp. capacity per month, although as will be seen presently there is evidence that sand operators value capital even more highly.

### *Operating Cost of Diesel Power*

Operating charges include fuel, oil, lubricant, waste and incidentals. Suitable oil can be obtained today (in 1931) for 3c. per gal., and many engine builders will guarantee their machines when new and at full load to use less than 0.45 lb. per hp.h. Fuel oil is not liable to remain at its present price, however, and a study of a considerable number of older engines indicates that consumption over long periods is liable to be about 8 gal. per 100 hp.h. Allowing for a probable increase in the price of oil to 4c. per gal., and making further allowance for lubricants and waste, it will be found that the direct cost is close to 0.5c. per kw.h.

Curve *B* shown in Fig. 2 is based on an assumption of fixed charges derived as described above and on an operating cost of 0.5c. per kw.h. Comparison will show that it is more favorable than any of the purchased power rates, above 200 hours' use and more favorable than some of them at 100 hours' use.

The actual distribution of internal combustion engines in the Plains District, however, conforms much more closely to the condition indicated by the Curve *C*, in which it is assumed that working capital is too valuable to tie up in fixed plant, at less than 20%. It is, however, possible that fear of shutdowns in plants with insufficient storage may be a factor in preventing the use of these engines except where the direct saving is very large.

Curve *A* represents costs based on $60 per hp. installation charge and a slightly increased rate for repairs, and corresponds to results which should be possible with some of the newer and lighter engines, turning at higher speeds than have been used in the past. This type of engine is still in the experimental stage, and several designs have been brought out which were not entirely successful. On the other hand, certain types are making good. The development of Diesel airplane motors, weighing 3 lb. per hp., and reliable for 1,000 hours continuous operation, and the adoption by the German Navy of engines weighing 25 lb. per hp. for drives in their battleships, are sufficient indication of the possibilities of this form of power. Some of the chief advantages of these light engines are that they require no larger barges than do electric motors, that they require no foundations, and that many of them are suitable for direct connection to pumps. The increasing development of engines of this type will probably bring widespread application.

It will be noted that the most serious and doubtful items in Diesel expense are the fixed charges. Certain manufacturers are now obviating this point of controversy by installing engines to be paid for from savings. If the power rate has been about 2c., and the new engine operates at 0.5c., it is clear that there is a saving of 1.5c. per kw.h., and at 200 hours per month this will amount to $3 per month. If the engine cost $90 per brake kw. capacity, the savings would pay for the installation in 30 months, though there would be no gain to the user in the meantime.

### *Gasoline Motor Power*

As a source of power the gasoline engine demands some consideration. Excellent en-

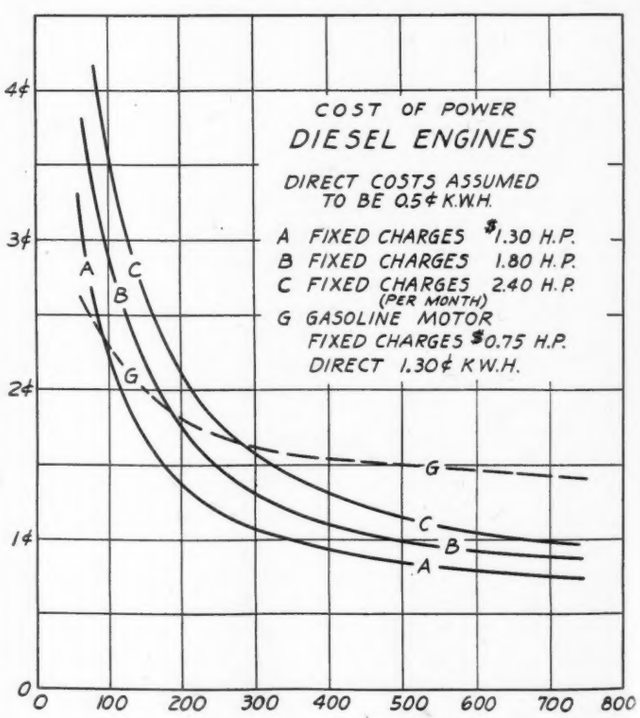



***Fig. 2. Comparison of power costs with Diesel and gasoline engines for various hours of operation per month***

gines can be bought for $20 per horsepower and some high speed units cost as little as $10. The life of these engines like that of the Diesels is debatable. The writer knows of a number of 1,200-r.p.m. units which after 7,000 hours of service are still in excellent shape, though they have had many replacements and repairs. Where good repair facilities are to be had, obsolescence determines the date of scrapping, which will generally be at about 10,000 hours of operation, or at 5 years' time.

Curve *G*, Fig. 2, is derived for a gasoline motor assuming 5-year life, $2 per hp. per month for repairs, and a cost of $20 per hp. with money at 12% and gasoline at 8c per gal. It will be noted that the rate below 200 hours' operation is by no means a bad one. If natural gas or butane is used as a fuel on a "step rate" the cost per installed horsepower will rise due to lowered capacity. The operating cost will also rise in the lower hours of use, but fall in the higher, finally plotting in a curve very similar to the Diesel Curve *B*.

Gasoline engines are all rather high speed machines, and to keep belt speeds down is difficult. In most cases drive should be through silent chain or herringbone reduction gears. The chief objection to the gasoline unit is its tendency to minor breakages, and to either lose power or waste fuel if not in nearly perfect adjustment. Few gasoline units have been retained in permanent plants, but for intermittent temporary or "standby" work they will furnish about the cheapest power obtainable.

As has just been said, for direct connection to the main barge pumps, the internal combustion engine is a serious competitor with purchased power, and is liable to become increasingly so. When used to drive machinery on shore, however, a different set of conditions exists. Conveyors, car pullers, hoists and small pumps can be driven by line shafting but the resulting arrangement is often both undesirable and inefficient. If electric drive and remote control are desired, an independent plant must generate and transmit this electricity. Slow-speed generators are heavy and costly, and must be housed. The cost of installation will run close to $200 per kw. for large Diesels, and there will be at least 10% loss in generating and transmitting current. Even so, the costs will compare favorably with many purchased power rates, unless extra supervision is necessary. Where it is necessary to spend from $1,800 to $2,000 per year in supervision of a small private plant, purchased power will almost invariably prove cheaper.

#### *Conclusions Regarding Power*

The discussion just given is based on what appear to the writer to be reasonable assumptions under the conditions. It may seem to internal combustion engine enthusiasts, and to persons operating in the East, that the rates of interest assumed on capital are very high; yet the writer has noted among the many small but growing industries on the Plains that those which conserve their working capital are the ones which ultimately succeed. In such a situation as that existing at present, expensive plants become simply frozen assets, and many a promising concern has failed from too much plant. On the other hand it may appear to commercial power advocates that the writer has not sufficiently emphasized standby charges, and losses caused by breakdowns. The writer has noted several severe accidents to Diesel motors, but although two of them resulted in repair bills amounting to 10% of the cost of the installation, neither resulted in a sufficient shut-down to delay contract deliveries. In one case the cause was the purchase of an engine, the makers of which maintain no experimental or testing force, and the engine is merely a bad copy of a competitor's discarded design. In the other, the accident was caused by an attempt of the engine man in charge to improve on the maker's design. If ample stock piles are carried, shut-downs for repair should not prove serious. On the contrary, the writer has available the record of another engine, loaded right up to its rating, which in some seventeen years of service has had no repairs or replacements other than two cylinders and heads, some rings, and one set of bearings. It is his belief that engines are now being built which under good management will give lower costs than any here discussed.

In the Plains Region plants are comparatively small and widely scattered. Many of them are far from sources of commercial power. Some are located immediately adjacent to gas fields, and oil refineries. The condition is favorable to the internal combustion motor. On the other hand, light weight is essential and low first cost highly desirable. There is urgent need of light, cheap, prime movers. Such engines are now being developed for marine service, and are proving very successful. The light internal combustion motor, adapted to cheap fuel, is bound to become an increasingly severe competitor of commercial power. It may be fairly assumed that this competition will cause a lowering of power rates, and the question of what constitutes the "best" power will probably never be settled. Careful analysis of conditions will, however, indicate the proper power for the particular job.

(*To be continued*)

## Illinois Mineral Industry in 1931

A PRELIMINARY SUMMARY of the mineral production and a review of the economic conditions of the state of Illinois are contained in report of investigations No. 25, "Illinois Mineral Industry in 1931," recently issued by the State Geological Survey. Information is given on portland cement, sand and gravel, limestone, and fluorspar which might be of value to certain producers interested in activity in this locality.

## Brinell Test of Keene's Cement

KEENE'S CEMENT, which is a type of dead-burned gypsum plaster, is commonly regarded as possessing certain advantages over ordinary plaster of Paris for plaster work. Of these advantages, the main one is that of hardness of surface. Therefore, when the properties of Keene's cement were being investigated with a view toward formulating Federal specifications, it was suggested that the Brinell hardness test, such as is used for testing metals, be tried on castings made from the various types of Keene's cement, as well as the ordinary calcined gypsum (plaster of Paris).

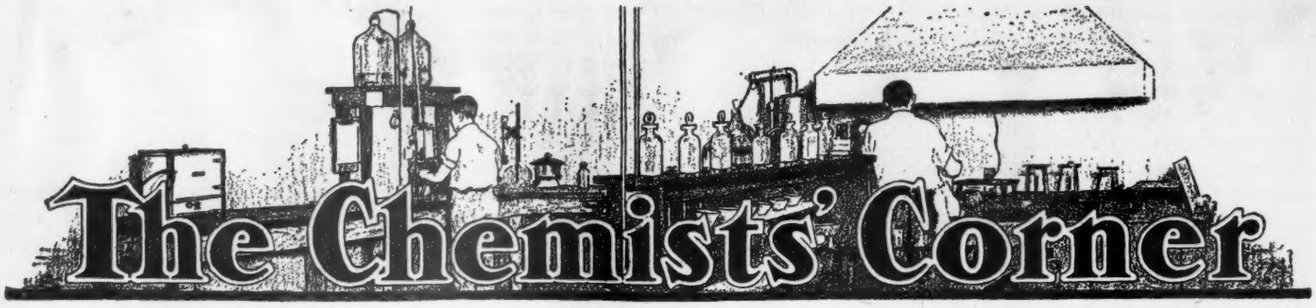
Tests were made on 2-in. cubes made from nine different Keene's cements. Three consistencies of each material were used. A few tests were also made on cubes cast from plaster of Paris. A pressure of 500 kg. was applied for one minute through a steel ball 17.5 mm. in diameter on to the surfaces of the cubes. Four tests were made on each cube, one on each of the surfaces cast in contact with the mold. The diameter of the resultant indentation was measured by means of a micrometer microscope to the closest 0.1 mm. The Brinell number is the load per unit of spherical surface of contact.

In some cases, mostly among the specimens of regular plaster of Paris, the specimens broke when the load was applied. Strength tests on other cubes cast of the same materials showed that these castings had in all cases a compressive strength of 3000 lb./in.$^2$. Of those materials which did not break, only one mix gave a strength below 3200 lb./in.$^2$ in compression.

The indentations ranged from 6.7 to 9.7 mm. (Brinell numbers of 14.4 to 6.3) for the Keene's cements tested. The cubes made from the calcined gypsum either broke because of their lower strengths or gave indentations slightly larger than 9.7 mm. Test specimens made from a special type of dental plaster gave the low indentation of 5.8 mm.

It was found that the compressive and tensile strengths are both related to the Brinell number, the higher the strengths the larger the Brinell number or the smaller the indentation. The compressive strength of the Keene's cements ranged from 5760 to 3070 lb./in.$^2$, the mixes showing these extreme values being the same as those which gave the extreme Brinell numbers. The special dental plaster showed a compressive strength of 9300 lb./in.$^2$.

From the data obtained it would appear that the Brinell test might be better than the strength tests in testing Keene's cement. It measures more directly the property desired in the material and is also a very simple test which can be performed in a short time. The several tests on the same cube and those from other cubes of the same mix checked within 0.3 mm. in all cases.—*Technical News Bulletin* of the U. S. Bureau of Standards.




# The Recast Analysis and Its Relation to the Chemistry of Portland Cement*

## Part II—Meaning of Recast Analysis

By Louis A. Dahl

Research Chemist, California Portland Cement Co., Colton, Calif.

CEMENT CHEMISTS have used empirical ratios or moduli to express the relation between the components of raw materials used in the manufacture of portland cement. With the present tendency to work toward the upper limit of lime percentage it has been generally realized that such empirical ratios fail to express correctly this variable upper limit and efforts have been made to develop formulae to repace some of the old ratios. In the first instalment of this series of articles, published in ROCK PRODUCTS, June 18, 1932, the author explained a new method of developing such formulae. He found that it is not sufficient to base the composition limits on compounds believed to be present in the cement, but considers also the course of crystallization and the influence of composition upon the percentage of melt during burning. A method of recasting the analyses to apply to this was given.—THE EDITORS.

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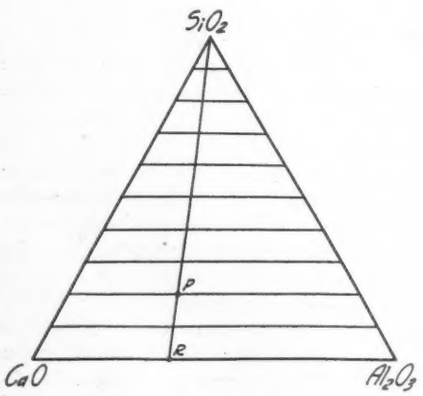



***Fig. 1. Triangular diagram to show $SiO_2$ percentages only***

### *Section 2. The Meaning of the Recast Analysis*

As a basis for the development of principles pertaining to the constitution of portland cement and to such problems as the computation of raw mixtures, a systematic method has been presented for deriving equations for recasting analyses into terms of compounds. The method may be applied to any number of components. Before attempting to apply recast analyses to portland cement problems it is well to inquire into the meaning of the recast analysis. The best means of forming a proper conception of the meaning of the recast analysis, and of the equations for recasting analyses, is to study them as translated graphically in composition diagrams. The triangular diagram representing a system of three components is especially convenient for that purpose, and has been chosen for illustrating the method of recasting analyses. The same three components, CaO, $SiO_2$ and $Al_2O_3$, and the same three compounds, $3CaO \cdot SiO_2$, $2CaO \cdot SiO_2$ and $3CaO \cdot Al_2O_3$, will be used to illustrate the meaning of the recast analysis.

Fig. 1 illustrates the general scheme by which compositions are located in the triangular diagram. The three components entered at the vertices represent the components entering into all compositions in the triangle. The triangle is divided into 10 parts by lines equally spaced and parallel with the base of the triangle. These lines represent 10% intervals in the percentage of $SiO_2$. The vertex $SiO_2$ represents 100% $SiO_2$, and the base of the triangle represents zero per cent. $SiO_2$. The point $P$ obviously represents a composition in which 20% $SiO_2$ is present. It will be noted also that the distance from $R$ to $P$ is one-fifth, or 20%, of the distance from $R$ to the $SiO_2$ point, which provides another means of determining the percentage of $SiO_2$ in $P$. It should be noted that the percentages are read from the side of the triangle opposite the $SiO_2$ point, and are read toward the $SiO_2$ point.

Following the scheme for the other components, the percentage of CaO may be read from the $SiO_2$-$Al_2O_3$ side toward the CaO point, and the percentage of $Al_2O_3$ may be read from the CaO-$SiO_2$ side toward the $Al_2O_3$ point. In Fig. 2 the triangle is divided into 10% intervals in accordance with this scheme. The point $P$, occupying the same position as in Fig. 1, represents 20% $SiO_2$, 30% $Al_2O_3$, 50% CaO. The percentages of the three components indicated by any point in the triangle total 100%.

An important property of the triangular diagram is illustrated by the points $P$, $M$ and $S$. Any mixture of $P$ and $S$ is located on the line joining $P$ and $S$. The fractional proportions of $P$ and $S$ in the mixture $M$ are indicated by the location of the point $M$ on the line $PS$. The fractional proportion

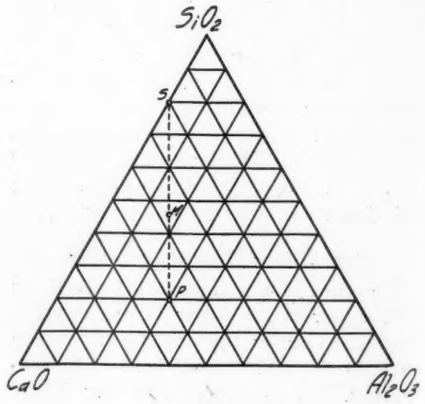



***Fig. 2. Triangle divided to show percentages of all three components***

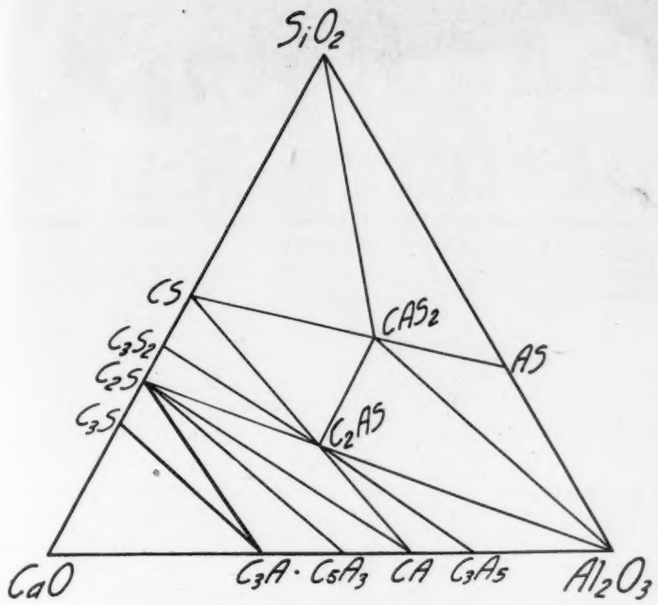



***Fig. 3. Triangular diagram representing final products of crystallization***

of $P$ in the mixture $M$ is equal to $MS$ divided by $PS$. Stated in terms of percentages, it may be said that the percentage of $P$ in mixtures on the line $PS$ may be read from $S$ toward the point $P$, if the line $PS$ is divided on a percentage basis. If this is compared with the conditions governing the composition on the sides of the triangle, it will be seen that the relations are the same. It has been stated that the sides of the triangle represent two-component systems. Similarly, if $P$ and $S$ are regarded as *components* of a series of mixtures, the line $PS$ may be regarded as a two-component system. The general statement may be made that any straight line in the triangle may be regarded as a two-component system in which the components are located at the extremities of the line.

Fig. 3 is a triangular diagram representing the final products of crystallization of the system $CaO$-$Al_2O_3$-$SiO_2$, as found by Rankin and Wright. For the purpose of simplifying the designation of compounds in that system the letters C, A and S are used to represent CaO, $Al_2O_3$ and $SiO_2$ respectively. The compound $3CaO \cdot SiO_2$ is represented by $C_3S$, $2CaO \cdot SiO_2$ by $C_2S$, and $3CaO \cdot Al_2O_3$ by $C_3A$. This scheme of abbreviating chemical formulæ of compounds in this system was originated by Rankin and Wright. It will be used throughout the remainder of this discussion.

According to the principle already stated in regard to the meaning of a straight line in the triangular diagram, it may be stated that a straight line joining any two compounds indicated in the triangle (Fig. 3) represents a two-component system, in which the compounds at the ends of the line are regarded as components. The sides of the triangle $C_3S$-$C_2S$-$C_3A$ (indicated in the figure by heavy lines) represent the following two-component systems: $C_3S$-$C_4S$, $C_2S$-$C_3A$ and $C_3A$-$C_3S$. The triangle itself represents the three-component system $C_3S$-$C_2S$-$C_3A$.

When a composition is expressed in terms of these three compounds it may be located in the triangle $C_3S$-$C_2S$-$C_3A$ in the same manner as a composition in terms of the oxides is located in the main triangle. The recast analysis is consequently seen to be a conversion from a system in which oxides are regarded as components to a system in which compounds are regarded as components. Mathematically the process of recasting analyses is a process of transformation of coordinates.

When an analysis expressed in terms of oxides is converted into terms of compounds, the composition so expressed is the composition which will be obtained if the compounds indicated in the recast analysis are actually present, and if all of the material consists of those compounds. Even when this is not true, the recast analysis indicates correctly what the percentages of the compounds would be if it were true. The recast analysis consequently may represent an actual compound composition, or it may represent a possible, or *potential*, composition.

Because of this distinction the writer prefers to use the term potential composition in all cases in which the calculated compound composition is not definitely known to represent actual percentages of the compounds present. In some cases the potential composition may be computed when it is definitely known that none of the compounds are actually present. For instance, the analysis of a mixture of raw materials may be calculated into terms of compounds in order to learn what the percentages of the compounds will be if all of the oxides present are transformed into those compounds. In the early part of this paper the term compound composition has been used without any effort to distinguish between actual and potential composition. In the remainder of the paper the distinction will always be made.

*(To be continued)*

## Autoclaving as a Durability Test for Concrete Aggregates

AMONG the various methods for testing concrete aggregates to obtain an estimate of their durabilities, those which are generally conceded to give the most reliable indications require so much time as to be unusable. It has been suggested that an autoclave test, similar to the one sometimes used as a soundness test for cement, might be useful for detecting the likelihood of aggregates to expand during exposure. This test would have the advantage of speed, provided that one or two autoclavings were sufficient. A few tests of aggregates were made to determine whether indications of durability could be detected after a few cycles of autoclaving and drying.

The Bureau of Public Roads cooperated by furnishing 14 samples of aggregates, including three of dolomite, which had been judged unsuited for use in concrete pavements. These were submitted to two treatments in steam at a pressure of 600 lb./in.$^2$ for five hours and 12 treatments in water at 150 lb./in.$^2$ pressure (366 deg. F.) for 24 hours. The specimens were dried at 230 deg. F. for about 17 hours between each test. The three poor aggregates showed a very slight amount of disintegration. The time required, however, was too long for the test to be useful in specifications.

Samples of the aggregates were submitted to 20 cycles of boiling in water for five hours, followed by 17 hours of drying at 230 deg. F. The unsatisfactory specimens showed about the same amount of disintegration as with the autoclave tests. This test was too slow for use as a specification test.

Samples of the three poor aggregates were crushed to pass a No. 4 sieve. These, with two samples of poor fine aggregates, furnished by the Bureau of Public Roads and a sample of shale, were made into pats with a 1:1 by weight cement-sand mortar. One set of these pats was tested in steam at 880 lb./in.$^2$ pressure for 24 hours. There was no disintegration in any of them. Another set was subjected to 10 cycles of boiling for five hours and drying at 230 deg. F. for 17 hours without showing signs of disintegration. Similar mortar pats of mixtures of portland cement, plaster of Paris and fine aggregates were disintegrated by an autoclave treatment, but the disintegration was about the same with the sound as with the unsound aggregates.

The results of the tests indicate that the autoclave test, in which the pressures are built up and released slowly, does not offer much promise of being a satisfactory one for including in specifications for aggregates.—*Technical News Bulletin* of the U. S. Bureau of Standards.

## Durability of Slates for Roofing

A DESCRIPTION of the properties of typical slates and of the processes of weathering to which they are subjected, together with the tests which may be applied in order to estimate their resistance, is given in a bulletin, "The Durability of Slates for Roofing," recently published by the Department of Scientific and Industrial Research, London, England.

# Hints and Helps for Superintendents

## Handy Tools for Cable Repair

By W. E. WARNER
Herts, England

ACCOMPANYING illustrations show a device to use when making thimbles in steel cables. Fig. 1 shows a device for making loops. The framework is made of cast iron or mild steel. In the center is a form *A* which is the shape of the loop to be formed. Several of these forms of different shapes and sizes can be used, enabling a wide variety of loops to be made. When the jig is in use the bolts *C C* and *D* should be slacked back, the cable placed around the form *A* as shown in the sketch. The bolt *D* is then tightened so that the cable is tightly

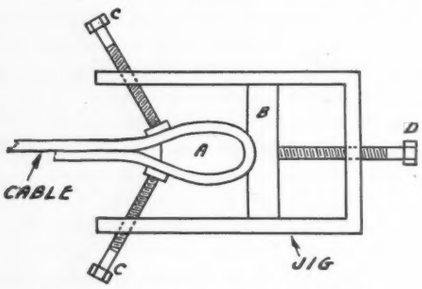



***Fig. 1. Device for making loops***

held by the block *B*. The bolts *C C* are then tightened, the cable being pulled tightly around the form before final tightening. This will hold the cable to the desired shape, so that the ends can be bound without further trouble.

Fig. 2 shows a device to hold a cable when splicing. It consists of a framework *E* at the extremities of which are two tubes *F F* for holding the cable. These tubes are large enough to take the longest cable to be handled. In these tubes is placed a piece of curved tubing mounted on a bolt *G*, the tube

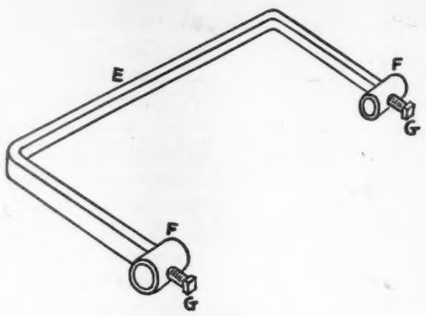



***Fig. 2. Device to hold cable***

being tapped to take the bolt *G*. This is for tightening the cable in the tube. It enables the pressure to be distributed better than a plain bolt which would dig into the cable. In using it the cable to be jointed is placed through the tubes *F F* the correct distance and then the nuts *G G* are tightened. By this means the cable can be firmly held in any position desired. The design of the framework premits work on the splice without interference.

## Crushed Stone Producer Makes Bituminous Road Material

AN INCREASING MARKET is reported to be developing for an asphaltic type of road material being produced by the Ziegenfuss Quarries, near Allentown, Penn. The material which is mixed with its crushed stone is called Ugite, and must be kept warm to obtain a satisfactory mix.

In the early development at the Ziegenfuss Quarries, Ugite was shipped in in barrels but it was soon evident that a more economical method of handling was necessary if the production was to be profitable. A 10,000-gal. tank was therefore installed, as shown in an accompanying illustration. It was elevated about 10 ft. above the ground and directly underneath the tank, in a concrete pit, an electric pump was installed to handle the material from tank cars to the storage tank.

Underneath the tank a small building was also built to house a steam boiler for heating the material in the tank. A number of coils were placed in the tank and live steam is circulated through them to maintain a suitable temperature.

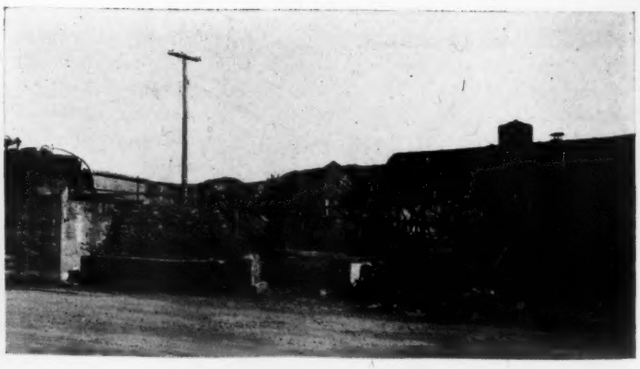
The present mixing installation consists of a mixer which handles one-ton batches of stone. To the stone is added 3 gal. of Ugite, which is thoroughly mixed with the stone. It may then be loaded direct to trucks for delivery, but Mr. Heiberger, the general manager, says that the greater part of the prepared stone is placed in a storage bin, where volatile matter in the Ugite evaporates to make a more suitable consistency for road work.

The present installation has proved satisfactory and a pleasing amount of business has been developed.

## Air Compressor for Sand and Gravel Operation

THE Makins Sand and Gravel Co., Sulphur, Okla., built in 1930-31 one of the most modern sand and gravel plants in the Southwest. The deposit is a cemented conglomerate similar to many of the gravel deposits in that section, including the Panhandle district of Texas. This particular deposit has to be churn-drilled and blasted along lines similar to a small scale quarry operation. The gravel not only has to be loosened but literally shot down, and even some secondary shooting is necessary.

***Crushing and screening plant of Ziegenfuss Quarries***



***Mixing plant for bituminous material***

*Tractor transports portable compressor to gravel pit for secondary shooting*

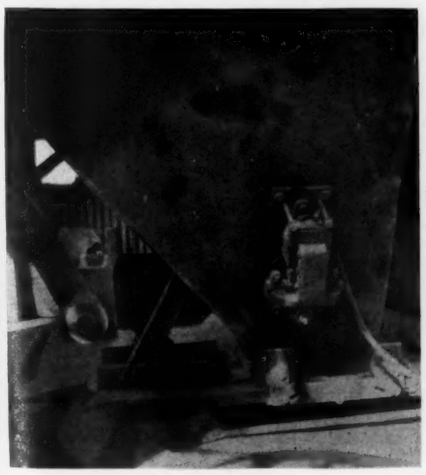
While the amount of secondary shooting is small, nevertheless it is sometimes necessary, as often chunks of cemented gravel too large for the primary crusher are shot down. These can be mud-capped or drilled by the use of jackhammers and an Ingersoll-Rand portable air compressor.

To provide for transporting the compressor to and from the point of use a Fordson tractor has been provided. The tractor can also be used in a thousand and one ways around a gravel pit, as almost every sand and gravel operator now knows. But to have to use such a device in a gravel pit for secondary shooting is certainly unusual.

## Vibrating Bin Cleaner

EMPTYING a bin or hopper containing portland cement or gypsum is often a source of annoyance to the operator. Unless the hopper is built with exceptionally steep sides the finely ground dry bulk material will hang to the bin walls to make loading operations difficult. Sledge hammers are frequently resorted to in order to free the material. This only increases the resistance as the walls and floors become more battered.

This difficulty has been solved at the Morrisville, N. J., central mixed concrete plant of the Warner Co. by mounting a Schaffer Engineering and Equipment Co. electric vibrator to the side of the cement weighing hopper as shown in the illustration. A button which the operator may operate with his foot controls the vibrator. The device operates similar to an electric hammer. Besides hastening the flow of cement from the hopper the device insures a more thorough cleaning of each batch and prevents damage to the sides of the hopper.



*Vibrator is attached to side of bin*

## Handy Clip for Truck Delivery Orders

A CONVENIENT paper clip for the truck driver who must carry delivery addresses, orders, or similar slips of paper on his truck can be made by tacking a common flat-type, spring mouse trap to the inside of the truck cab or on the dash board. Papers clipped in this trap will always be readily available, and they will be in plain sight, thus preventing loss and avoiding possible delays in the delivery of materials.

## A Useful Interior Periscope

AN INGENIOUS METHOD has been worked out for actually seeing interiors of containers such as drums, barrels, cylinders, etc.

An illustration shows a man inspecting the interior of a drum by means of the device. It is simply a small periscope—an electrically lighted "interior periscope." The operator can clearly see any portion of the interior by simply moving the periscope up and down. He can quickly tell whether or not the interior is dirty or whether it needs repairing. The cost of cutting into the vessel to "take a look" is eliminated and as a result much money may be saved. Furthermore, this method is *safe*. The unsatisfactory naked flame method of inspection and the lamp bulb method have both caused many accidents and deaths.

*Inspecting inside of metal dum*

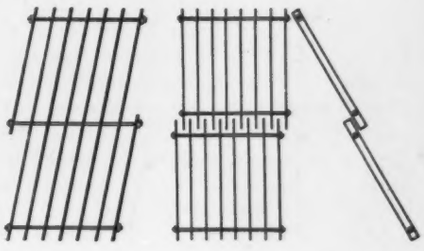
## Improvement to Grizzlies

By Charles Labbe
Death Valley Junction, Calif.

WHEN DUMPING a car of rock or ore upon a grizzly some of the rock will slide the whole length without having a chance to fall between the bars, even though it may be of the opening's size.

One improvement is to alter the arrangement of the bars, sawing one bar in half and by setting one-half of the bar at the other side of the grizzly a slanting course is given which increases the efficiency.

Yet a better way is to have the grizzly in two parts, setting the lower half out of line with the upper by just half the width of the bars' spacing and leaving a step of one or two inches to avoid choking; the jump breaks the straight travel in two directions and thus gives a better chance to do the work.



*Two designs to improve grizzly efficiency*

# Rock Products Clinic

## The Local Pit Delusion

THE EDITOR: During recent years a number of states have been permitting the use of local pit or quarry materials in the construction of highways, and a casual consideration of the subject might lead to the conclusion that the practice was economically sound, for in many instances the cost of the highways was somewhat lower than if they had been built with materials shipped by rail or truck from an established producer's plant; but analyzing the matter in detail shows quite the contrary to be the case, if the good of the community and the state as a whole be considered.

While state highway departments are to be commended for saving money wherever it is possible to do so, there is nothing economically sound in one department of a government saving money at the expense of other departments of the state, or at the expense of the people of the state as a whole.

The local pit operator, because of the small size of his operation, necessarily has a much higher production cost than the regular established producer shipping by rail to many customers, and the local pit is only able to exist because, being close to the point of use of the material, certain freight or hauling charges are eliminated. In other words, a small uneconomical local operation absorbs much of the money that should, for the greatest benefit to the people as a whole, go to the labor required to operate and maintain a railway or furnish employment to men driving trucks.

The economic use of money, so far as our people as a whole are concerned, demands that we distribute the money to the greatest number, in other words, provide the most jobs; for, the more jobs, the more people who will be benefited and the more prosperous the country will be. Giving one man $10,000 obviously benefits the country far less than distributing the $10,000 among ten men; for, while the one man may make a few large purchases, the ten men will make many small purchases and far more people will be benefited.

Let us consider a ten-mile road job involving, say, 40,000 tons of sand and crushed stone or gravel. A good contractor will lay one mile of pavement per week, so the above job would take material for about ten weeks. If the material were furnished by a local pit operator he would probably not be on the job over 13 weeks, including the time spent in opening up his pit, erecting his little portable plant, producing the material and dismantling the plant. His crew would probably not exceed six men, and the direct benefit to the community would therefore be, say, 13 weeks' work for six men.

After the completion of the job the six men would have to seek work elsewhere and the local pit operator and his portable plant would be many miles away; indeed, perhaps in another state. The local pit operator, obviously, would pay no taxes to the community, if indeed any to the state, and the men could not purchase or lease homes or safely move their families to the community when they knew they would soon be out of a job. No merchants would open stores; no industries would be attracted; no schools would be built; no permanent improvements whatever would result anywhere. The picture would be that of a small transitory operation that benefited no one permanently.

Now, say the materials came from an established producer. The producer would probably have a crew of at least 20 men, and, by reason of supplying materials to other construction work in addition to the road job we are considering, he would be able to keep his plant going steadily and his men, having steady jobs, could purchase or lease homes and contribute steadily to the community. The established producer would pay both local and state taxes, purchase electric power, fuel and supplies in the community, pay for insurance, clerical help, and the other services required to conduct a business, or, in short, would do everything a permanent industry does and be a real asset to the community.

If the materials moved by rail, as they would in most instances, the railway train crews, the track maintenance crews, the station agents and clerks, the telegraph operators and all of the many men employed by the railways would be benefited, and these men, as well as the railway itself, would have the means to pay taxes to the state and communities and purchase the goods of the merchants and the produce of the farms.

It is quite easy to see how few people are benefited when materials are produced by a local pit operation, but it is wholly impossible to compute how many are benefited when the materials come from an established producer.

"NORTHWEST PRODUCER."

### *Your Opinion Is Solicited!*

***THE much lower prices for aggregates have brought many producers very sharply face-to-face with a critical question that to some at least was more or less academic before. How can they compete with the side-of-the-road producer?***

***The railways in some instances have helped the established producer by making lower short-haul rates. The highway departments have tried to help in a few instances by directly or indirectly favoring the established producer. The producer himself has tried by cutting the price beyond all hope of profit.***

***There remains one way for the established producer to meet this competition that so far as we know has not been tried. The established producer can operate portable plants himself; and with a permanent crew and operating experience can make them profitable if anyone can.***

***We are, of course, familiar with many of the arguments commonly used by commercial producers as to why they should not own and operate portable plants in competition with their established plants. But opinion may be changing; we are told that it is.***

***We should very much like to see a frank discussion of the pros and cons; and we believe this page is a good place to have it!***

***The Editors.***

## Wanted—Data on Blasting

THE EDITOR: Each and every one of us connected with the rock products industry undoubtedly has a hobby which we are riding harder in these depressing times than we would under conditions which existed four or five years ago, but I wonder whether everyone has the gall to plague strangers with our hobbies? I am going to try to do that very thing to you—I hope you can help me.

In pursuing my hobby, which is blasting, I have run into a snag. I have studied the chemistry of the various materials used in blasting, the uses of these materials, the costs of the materials and cost of blasting in mines and quarries, but I have been unable to find any information as to how an expert or an authority on blasting proceeds on a new job.

Suppose for a moment that an operator of a quarry is having difficulty securing the proper fragmentation or he is about to open a new quarry. He knows nothing about the fundamentals of blasting and is therefor forced to solicit the aid of an authority in this field. The authority appears on the job, from his knowledge of geology and stratigraphy he is able to determine the type of rock in the quarry, the degree of fissuring, etc.; now how does he go about correlating this information with the strength of blasting materials to use and how much should be used? Of course you will say that he has learned that from past experience, but suppose he has had no previous experience, what does he do?

To my mind there must be some way of correlating the strength, that is, the tensile and compressive strengths, of rocks with the amount of explosive economically employed in the majority of blastings.

"MIDWEST SUPER."

## Editor's Note

We have referred our correspondent to the hand books published by the explosives manufacturers. Possibly our readers can make other suggestions—all will be welcome.—THE EDITOR.

# Editorial Comment

**Getting Back to Normal!**

With the evident turn for the better in business sentiment it is time for producers in the rock products industries to get their feet firmly on the ground and take a preview of what the near future holds in store for them—looked at with neither blue-hued nor rose-colored glasses. If they will do that they will find nothing to be alarmed about, nor, to be frank, nothing to become particularly enthused over. It is to be hoped they will see and realize the need for sober reflection and coordinated action.

Portland cement shipments this year probably will not exceed 75,000,000 bbl. That is 100,000,000 bbl. less than shipments in 1928. But we should not cast our eyes back at the good old days of 1928 and expect to achieve profits in 1933 or 1934 on a volume production of 175,000,000 bbl. A much fairer goal to aim for in 1934 would be 140,000,000 bbl., which is the *average* annual production of the 12 years 1921 to 1932, inclusive. That is about the annual production of 1923-24. We must put our houses in order to be satisfied with that consumption.

Now, 140,000,000 bbl. is some 120,000,000 bbl. less than the alleged capacity of the existing industry; it is roughly 50% of the existing capacity. Therefore it is worse than useless, it is insane, to expect profits from the production of portland cement for the next few years through a return to anything like capacity operation of existing equipment. The only sane method of approach to a profitable operation of the industry is to abandon or scrap obsolete plants, or parts of many plants that may not be considered obsolete at the moment. Producers will be fooling no one but themselves to keep these plants on their books; and they are a constant menace to profits in this industry.

If a producer honestly and openly faces the problem of operating a mill at 50 to 60% of its rated capacity during the next four or five years *at a profit* he will not attempt to maintain a plant with four old kilns where one new and modern one will answer all requirements; he will revamp and modernize his material handling equipment, because if this is laid out for a four-kiln plant it seldom can be made to handle production of a one-kiln plant efficiently. Many a plant that is modern so far as much of its equipment goes is obsolete in material handling—obsolete in design by every modern standard.

It is assumed that producers will adopt a "live and let live" policy, having been fairly well educated that other ways of doing business are not profitable. The only alternative is a series of mergers which will make possible abandonment or scrapping of obsolete or, at least, unnecessary plants. This course is dangerous because a merger, or a "trust," is always an invitation and a sales argument for promoters of new plants.

One of the best moves producers in the cement industry could make would be to frankly and honestly announce that certain mills had been definitely and finally closed, or would be rebuilt at a much lower rated capacity. The industry would not then be constantly in fear of "overproduction." Costs of manufacture and selling prices would then take care of themselves. Everyone knows that many such mills cannot be operated at a profit now and time will make them definitely obsolete; nothing is to be gained by trying to "kid" ourselves or anyone else to the contrary. The constantly repeated figures of "capacity" and of "operation at 30-40% capacity" in government statistics is a millstone on the neck of every producer.

It would seem that a great deal of good could be done the industry by such voluntary "concessions" rather than by attempting to operate these mills until their owners are forced into bankruptcy. The ultimate result so far as these particular mills are concerned will be the same, but instead of immediate attainment of a profitable industry there will be years of profitless operation, ill-feeling, lack of association support, lack of money for promotional work so vitally needed now, and other misfortunes too numerous to mention. If a producer desires to maintain an organization let him buy his needs from a modern plant, at least until conditions justify rebuilding his own mill.

The problem of the other rock products industries is similar. In the case of aggregates, sand, stone, gravel and slag the problem is made more complicated by the rise of small transient producers, because of high freight rates and low selling prices. We believe that it would be a business-like move for the national associations in the stone and gravel industries to make thoroughgoing investigations of the portable plant, or semi-portable plant, as a means of supplementing their own established operations, rather than to seek ways of eliminating them from the picture entirely.

It is difficult to battle successfully a strong economical trend. If transportation rates are destined to remain high relative to the price of aggregates, as seems likely, and if satisfactory aggregates for many kinds of public work such as highways can be produced locally, they will be produced locally in spite of all the forces and influences the established industry can bring to bear for their abolition. And the products of such local, temporary operations might be vastly improved in some cases by mixture with commercial materials from an established plant. In other words, "half a loaf is better than none." If local production of some or of all the aggregates for a specific job is economical and profitable, the opportunities to produce and sell these local materials should not be overlooked by the wide-awake commercial producer. His experience, his capital, his organization, his business acquaintance certainly should place him in a much more favorable position to profit from this business than the type of portable plant operator now far too common.

# Financial News and Comment

## RECENT QUOTATIONS ON SECURITIES IN ROCK PRODUCTS CORPORATIONS

| Stock | Date | Bid | Asked | Dividend |
|---|---|---|---|---|
| Allentown P. C. 1st 6's[27] | 7-12-32 | 93 | 98 | |
| Alpha P. C. com. | 7-11-32 | 4½ | 6 | 25c qu. Apr. 25 |
| Alpha P. C. pfd.[2] | 7-11-32 | 60 | 80 | 1.75 qu. June 15 |
| Amalgamated Phosphate Co. 6's, 1936[19] | 7- 8-32 | 70 | 80 | |
| American Aggregates com.[19] | 7- 8-32 | 1 | 3 | |
| American Aggregates pfd.[19] | 7- 8-32 | 10 | 20 | 1.75 qu. Jan. 1 |
| Amer. Aggr. 6's, w.w.[19] | 7- 8-32 | 31⅛ | 35 | |
| Amer. Aggr. 6's, ex.w.[19] | 7- 8-32 | 29⅛ | 33 | |
| Amer. L. & S. 1st 7's[27] | 7-12-32 | 70 | 80 | |
| American Silica Corp. 6½'s[39] | 7-12-32 | No market | | |
| Arundel Corp. com. | 7-11-32 | 14½ actual sale | | 75c qu. July 1 |
| Bessemer L. & C. Class A | 7- 8-32 | ..... | 2 | |
| Bessemer L. & C. 1st 6½'s[4] | 7- 8-32 | 11 | 16 | |
| Bloomington Limestone 6's[27] | 7-12-32 | ..... | 20 | |
| Boston S. & G. new com.[37] | 7- 7-32 | 3 | 5 | 5c qu. July 1 |
| Boston S. & G. new 7% pfd.[37] | 7- 7-32 | 20 | 30 | 87½c qu. July 1 |
| California Art Tile, A | 7- 8-32 | 1½ | 4¼ | |
| California Art Tile, B[9] | 7- 8-32 | ..... | 5 | |
| Calaveras Cement com. | 7- 8-32 | ..... | 2 | |
| Calaveras Cement 7% pfd. | 7- 8-32 | ..... | 70 | 1.75 qu. July 15 |
| Canada Cement com. | 7-11-32 | 2½ | 3⅛ | |
| Canada Cement pfd. | 7-11-32 | 21 | ..... | 1.62½ qu. June 30 |
| Canada Cement 5½'s[42] | 7- 7-32 | 64 | 68 | |
| Canada Crushed Stone bonds[42] | 7- 7-32 | 60 | 70 | |
| Canada Crushed Stone com.[42] | 7- 7-32 | 2 | ..... | |
| Certainteed Products com. | 7-11-32 | 1⅛ | 2 | |
| Certainteed Products pfd. | 7-11-32 | 6 | 8⅛ | 1.75 qu. Jan. 1 |
| Certainteed Products 5½'s | 7- 8-32 | 23¼ | 25 | |
| Cleveland Quarries | 7-11-32 | ..... | 54 | 10c qu. June 1 |
| Consol. Cement 1st 6½'s, A[44] | 7-12-32 | 4 | 7 | |
| Consol. Cement notes, 1941[27] | 7-12-32 | No market | | |
| Consol. Cement pfd.[27] | 7-12-32 | ..... | 45 | |
| Consolidated Oka Sand and Gravel (Canada) 6½'s[12] | 7- 8-32 | 70 | 80 | |
| Consolidated Oka Sand and Gravel (Canada) pfd.[42] | 7- 7-32 | ..... | 45 | 1.75 qu. Oct.10,'31 |
| Consol. Rock Prod. com.[35] | 7- 8-32 | 10c | 20c | |
| Consol. Rock Prod. pfd.[35] | 7- 8-32 | 35c | 65c | |
| Consol. Rock Prod. units[35] | 7- 8-32 | ½ | 1 | |
| Consol. S. & G. pfd. (Can.)[42] | 7- 7-32 | ..... | 45 | 1.00 qu. May 16 |
| Construction Mat. com. | 7-11-32 | ..... | 2 | |
| Construction Mat. pfd. | 7-11-32 | ¾ | 3⅝ | |
| Consumers Rock and Gravel, 1st Mtg. 6's, 1948[35] | 7- 8-32 | 24 | 28 | |
| Coosa P. C. 1st 6's[23] | 7- 7-32 | 15 | 20 | |
| Coplay Cem. Mfg. 1st 6's[39] | 7- 8-32 | 40 | 50 | |
| Coplay Cem. Mfg. pfd.[33] | 6-23-32 | 10 | 12 | |
| Dewey P. C. com.[47] | 7-12-32 | 70 | 80 | |
| Dolese and Shepard | 7-11-32 | 14½ | 16 | $1 qu. Jan. 1 |
| Dufferin Pav. & Cr. Stone pfd.[42] | 7- 7-32 | ..... | 28 | 1.75 qu. Apr. 1 |
| Dufferin Pav. & Cr. Stone com.[42] | 7- 7-32 | ..... | 5 | |
| Edison P. C. com.[27] | 6-29-32 | 3 | 6 | |
| Federal P. C. 6½'s[47] | 7-12-32 | 55 | 60 | |
| Giant P. C. com.[2] | 7-11-32 | ½ | 2 | |
| Giant P. C. pfd.[2] | 7-11-32 | 3 | 8 | 1.75 s.-a. Dec. 15 |
| Gyp. Lime & Alabastine, Ltd. | 7-11-32 | 2¼ | 2½ | 10c qu. Oct.5,'31 |
| Gyp. Lime & Alabastine 5½'s[42] | 7- 7-32 | 33 | 38 | |
| Hermitage Cement com.[11] | 7- 9-32 | 2 | 6 | |
| Hermitage Cement pfd.[11] | 7- 9-32 | 22 | 30 | |
| Ideal Cement 5's, 1943[29] | 7- 9-32 | 60 | 75 | |
| Ideal Cement com.[29] | 7- 9-32 | 6 | 8 | 50c qu. July 1 |
| Indiana Limestone units[27] | 7-12-32 | No market | | |
| IndianaLimestone 6's | 7- 8-32 | 5½ | 10 | |
| International Cem. com. | 7-11-32 | 5 | 6¼ | 50c qu. Mar. 31 |
| International Cem. bonds, 5's | 7- 9-32 | 46⅞ actual sale | | Semi-ann. int. |
| Kelley Island L. & T. | 7-11-32 | 7 | 10 | 25c qu. July 1 |
| Ky. Cons. Stone com. | 7-11-32 | ..... | 2 | |
| Ky. Cons. Stone pfd. | 7-11-32 | ..... | 50 | |
| Ky. Cons. St. 1st Mtg. 6½'s[45] | 7- 7-32 | 15 | 20 | |
| Ky. Cons. St. V. T. C.[45] | 7- 7-32 | No market | | |
| Ky. Rock Asphalt com. | 7-11-32 | ..... | 1 | |
| Ky. Rock Asphalt pfd. | 7-11-32 | ..... | 25 | 1.75 qu. Dec.1,'31 |
| Ky. Rock Asphalt 6½'s | 7-11-32 | ..... | 70 | |
| Lawrence P. C. | 7- 9-32 | ..... | 9 | |
| Lawrence P. C. 5½'s 1942[2] | 7-11-32 | 28 | 33 | |
| Lehigh P. C. com. | 7-11-32 | 5 | 6¼ | |
| Lehigh P. C. pfd. | 7-11-32 | 48⅛ | 48½ | 1.75 qu. July 1 |
| Louisville Cement[7] | 7- 7-32 | 60 | 80 | |
| Lyman-Richey 1st 6's, 1935[13] | 7-11-32 | 90 | ..... | |
| Marblehead Lime 6's[14] | 7- 8-32 | No market | | |
| Marbelite Corp. com.[35] (cement products) | 7- 8-32 | 3c | 75c | |
| Marbelite Corp. pfd.[35] | 7- 8-32 | 50c | ..... | |
| Marquette Cement com.[47] | 7-12-32 | 2 | 4 | |
| Marquette Cement pfd.[47] | 7-12-32 | 40 | 45 | 1.50 qu. July 1 |
| Marquette Cem. Mfg. 1st 5's, 1936[16] | 7-12-32 | 70 | ..... | |
| Marquette Cem. Mfg. 1st 6's, 1936[16] | 7-12-32 | 80 | ..... | |
| Material Service Corp. | 7-11-32 | ..... | 10 | |
| McCrady-Rodgers 7% pfd.[22] | 7- 7-32 | 30 | 32 | 87½c qu. June 30 |
| McCrady-Rodgers com.[22] | 7- 7-32 | 1 | 5 | 75c qu. Jan. 26 |
| Medusa P. C. pfd.[47] | 7-12-32 | 45 | 55 | 1.50 qu. Apr. 1 |
| Medusa P. C. com. | 7-11-32 | 4⅝ | 5 | |
| Monarch Cement com.[47] | 7-12-32 | 50 | 60 | |
| Michigan L. & C. com.[6] | 7- 9-32 | 45 | ..... | |
| Missouri P. C. | 7-11-32 | 5 | ..... | 25c qu. Jan. 30 |
| Monolith Portland Midwest com.[35] | 7- 8-32 | 40c | 60c | |
| Monolith Portland Midwest pfd.[9] | 7- 8-32 | 25c | 35c | |
| Monolith P. C. com.[9] | 7- 8-32 | ½ | 1 | 40c s.-a. Jan. 1 |
| Monolith P. C. pfd.[9] | 7- 8-32 | 1.12½ | 2 | 40c s.-a. Jan. 1 |
| Monolith P. C. units[9] | 7- 8-32 | 2¾ | 5 | |
| Monolith P. C. 1st Mtg. 6's[9] | 7- 8-32 | 33 | 36 | |
| National Cem. (Can.) 1st 7's[27] | 7-12-32 | 80 | 90 | |
| National Gypsum A com.[27] | 7-12-32 | 1 | 2 | |
| National Gypsum pfd.[27] | 7-12-32 | 20 | 23 | 1.75 qu. July 1 |
| National Gypsum 6's[3] | 7-12-32 | 40 | 50 | |
| Nazareth Cement com.[25] | 6-10-32 | 3 | ..... | |
| Nazareth Cement pfd.[25] | 6-10-32 | 45 | ..... | |
| Newaygo P. C. 1st 6½'s[27] | 7-12-32 | 72 | ..... | |
| N. Y. Trap Rock 1st 6's | 7- 9-32 | 38 actual sale | | |
| N. Y. Trap Rock 7% pfd.[30] | 7- 7-32 | ..... | 35 | 1.75 qu. July 1 |
| North Amer. Cem. 1st 6½'s | 7- 8-32 | 13¼ | 14½ | |
| North Amer. Cem. com.[48] | 7- 9-32 | ..... | 1 | |
| North Amer. Cem. 7% pfd.[48] | 7- 9-32 | 1 | 2 | |
| North Shore Mat. 1st 5's[45] | 7-12-32 | 30 | ..... | |
| Northwestern States P. C.[47] | 7-12-32 | 25 | 30 | |
| Ohio River S. & G. com. | 7-11-32 | ..... | 8 | |
| Ohio River S. & G. 7% pfd. | 7-11-32 | ..... | 98 | |
| Oregon P. C. com.[9] | 7- 8-32 | 8 | 12 | |
| Oregon P. C. pfd.[9] | 7- 8-32 | 80 | 85 | |
| Pacific Coast Aggr. com.[40] | 7- 8-32 | ..... | ½ | |
| Pacific Coast Aggr. pfd.[40] | 7- 8-32 | ..... | 1 | |
| Pacific Coast Aggr. 6½'s, 1944[5] | 6-27-32 | 13 | 15 | |
| Pacific Coast Aggr. 7's, 1939[5] | 6-27-32 | 1½ | 3½ | |
| Pacific Coast Cement 6's[5] | 6-27-32 | 45 | ..... | |
| Pacific P. C. com. | 7- 8-32 | 3 | 6 | |
| Pacific P. C. pfd. | 7- 8-32 | 50 | 55 | 1.62½ qu. July 5 |
| Pacific P. C. 6's | 7- 8-32 | ..... | 94 | |
| Peerless Cement com.[21] | 7- 9-32 | 25c | 75c | |
| Peerless Cement pfd.[21] | 7- 9-32 | 3 | 5 | |
| Penn.-Dixie Cement com. | 7-11-32 | ½ | ⅝ | |
| Penn.-Dixie Cement pfd. | 7-11-32 | 3¼ | 5⅛ | |
| Penn.-Dixie Cement 6's | 7-12-32 | 27⅛ actual sale | | |
| Penn. Glass Sand Corp. pfd.[26] | 7-12-32 | 40 | 50 | 1.75 qu. Apr. 1 |
| Penn. Glass Sand Corp. 6's | 7- 7-32 | 70 | 75 | |
| Petoskey P. C. | 7-11-32 | 1 | 1½ | |
| Port Stockton Cem. com.[9] | 7- 8-32 | No market | | |
| Riverside Cement com.[9] | 7- 8-32 | ..... | 12 | |
| Riverside Cement pfd.[9] | 7- 8-32 | 55 | 60 | 1.50 qu. Feb. 1 |
| Riverside Cement, A | 7- 8-32 | ..... | 7 | |
| Riverside Cement, B[9] | 7- 8-32 | 70c | 1 | |
| Sandusky Cement 6½'s, 1932-37[19] | 7- 8-32 | 80 | 85 | |
| Santa Cruz P. C. com. | 7- 8-32 | 20 | ..... | $1 qu. July 1 |
| Schumacher Wallboard com. | 7- 8-32 | 1 | ..... | |
| Schumacher Wallboard pfd. | 7- 8-32 | 3 | 14 | 50c qu. May 15 |
| Signal Mt. P. C. pfd.[47] | 7-12-32 | 1 | 3 | |
| Southwestern P. C. units[35] | 7- 8-32 | 150 | 200 | |
| Southwestern P. C. pfd.[35] | 7- 8-32 | 70 | ..... | $2 qu. July 1 |
| Standard Paving & Mat. (Canada) com.[42] | 7- 7-32 | 1½ | 2 | |
| Standard Paving & Mat. pfd.[42] | 7- 7-32 | 27 | 30 | $1 qu. May 16 |
| Superior P. C., A[9] | 7- 8-32 | 23 | 27 | 27½c mo. Aug. 1 |
| Superior P. C., B[9] | 7- 8-32 | 4 | 5¼ | 12½c July 20 |
| Trinity P. C. units[47] | 7-12-32 | 20 | 25 | |
| Trinity P. C. com.[47] | 7-12-32 | 2 | 3 | |
| Trinity P. C. pfd.[47] | 7-12-32 | 18 | 21 | |
| U. S. Gypsum com. | 7-11-32 | 11¾ | 12⅞ | 40c qu. June 30 |
| U. S. Gypsum pfd. | 7-11-32 | 90 | 94 | 1.75 qu. June 30 |
| Wabash P. C.[21] | 7- 9-32 | 3 | 7 | |
| Warner Co. com.[47] | 7-12-32 | 2 | 3 | 25c qu. Oct.15,'31 |
| Warner Co. 1st 7% pfd.[47] | 7-12-32 | 45 | 50 | 1.75 qu. Apr. 1 |
| Warner Co. 6's, 1944, with war. | 7- 8-32 | ..... | 40 | |
| Whitehall Cem. Mfg. com.[30] | 7- 7-32 | ..... | 80 | |
| Whitehall Cem. Mfg. pfd.[30] | 7- 7-32 | ..... | 55 | |
| Wiscon. L. & C. 1st 6's, '33[15] | 7-12-32 | 35 | ..... | |
| Wolverine P. C. com. | 7-11-32 | ..... | 1 | 15c qu. Nov.15,'31 |
| Yosemite P. C. A. com.[9] | 7- 8-32 | 90c | 1.10 | |

Quotations by: [1]Watling Lerchen & Hayes Co., Detroit, Mich. [2]Bristol & Willett, New York. [3]Rogers, Tracy Co., Chicago. [4]Butler, Wick & Co., Youngstown, Ohio. [5]Smith, Camp & Riley, San Francisco, Calif. [6]Frederick H. Hatch & Co., New York. [7]J. J. B. Hilliard & Son, Louisville, Ky. [8]Dillon, Read & Co., Chicago, Ill. [9]A. E. White Co., San Francisco, Calif. [10]Lee Higginson & Co., Boston and Chicago. [11]J. W. Jakes & Co., Nashville, Tenn. [12]James Richardson & Sons, Ltd., Winnipeg, Man. [13]Stern Bros. & Co., Kansas City, Mo. [14]First Wisconsin Co., Milwaukee, Wis. [15]Central-Republic Bk. & Tr. Co., Chicago. [16]G. M. P. Murphy & Co., Baltimore, Md. [17]Citizens Southern Co., Savannah, Ga. [18]Dean, Witter & Co., Los Angeles, Calif. [19]Hewitt, Ladin & Co., New York. [20]Tucker, Hunter, Dulin & Co., San Francisco, Calif. [21]Baker, Simonds & Co., Inc., Detroit, Mich. [22]Peoples-Pittsburgh Trust Co., Pittsburgh, Penn. [23]Howard R. Taylor & Co., Baltimore. [24]Richards & Co., Philadelphia, Penn. [25]Hincks Bros. & Co., Bridgeport, Conn. [26]Bank of Republic, Chicago, Ill. [27]National City Co., Chicago, Ill. [28]Chicago Trust Co., Chicago, Ill. [29]Boettcher-Newton & Co., Denver. [30]Hanson and Hanson, New York. [31]S. F. Holzinger & Co., Milwaukee, Wis. [32]Tobey and Kirk, New York. [33]Steiner, Rouse and Co., New York. [34]Jones, Heward & Co., Montreal, Que. [35]Tenney, Williams & Co., Los Angeles, Calif. [36]Stein Bros. & Boyce, Baltimore, Md. [37]Wise, Hobbs & Arnold, Boston. [38]E. W. Hays & Co., Louisville, Ky. [39]Blythe Witter & Co., Chicago, Ill. [40]Martin Judge Co., San Francisco, Calif. [41]A. J. Pattison Jr. & Co. Ltd., Toronto, Canada. [42]Nesbitt, Thomson & Co., Toronto. [44]E. H. Rollins, Chicago. [45]Dunlap, Wakefield & Co., Louisville, Ky. [46]First Union Trust & Savings Bank, Chicago. [47]Anderson Plotz and Co., Chicago, Ill. [48]Hemphill, Noyes and Co., New York City.

## Ideal Cement Company

THE annual report of the Ideal Cement Co., Denver, Colo., and its subsidiary companies, the Arkansas Portland Cement Co., the Colorado Portland Cement Co., the Nebraska Cement Co., the Oklahoma Portland Cement Co., the Three Forks Portland Cement Co., the Union Portland Cement Co. and the United States Portland Cement Co., states that the total shipments of cement by the company during the year 1931 showed a decrease of approximately 13½%, as compared to the total shipments during the year 1930. The shrinkage in the use of cement in the territories served by the company was, however, much less than for the United States as a whole. The United States Government figures show only 47% of the available plant capacity used for shipments in 1931, and the best available construction reports indicate a reduction of 32% in 1931 as compared with 1930, and a reduction of 53% as compared with the peak year of 1928.

Satisfactory progress was again made during the year in the reduction of manufacturing costs and every economy put into effect.

The net earnings available for surplus and common stock dividends amounted to $471,981.42, as compared with $1,806,616.48 in the year 1930. This decrease in net earnings was due, first, to a reduction in the consumption of the product throughout the territory in which the company operates and, second, to the ruinously low prices prevailing generally throughout the country. The company paid out in dividends during the year $1,260,245.25. The difference between the amount of dividends paid and the net earnings, as shown, was drawn from surplus account accumulated during previous years.

The net current assets or working capital at the close of the year 1930 amounted to $8,540,028.76, whereas the corresponding figure at the close of the year 1931 amounted to $8,485,931.48, or approximately the same amount as at the close of the year 1930.

There was expended for plant improvements during the year 1931, $234,550.

CONSOLIDATED BALANCE SHEET OF THE IDEAL CEMENT CO. AND ITS SUBSIDIARIES
(As of December 31, 1931)
(All inter-company items eliminated)

ASSETS

| | | |
|---|---|---|
| Cash, industrial and municipal bonds and marketable securities | | $ 6,429,476.93 |
| Accounts receivable | | 293,554.93 |
| Manufactured goods | | 607,531.05 |
| Inventory, goods in process, supplies, fuel and sacks | | 1,434,168.11 |
| Total current assets | | $ 8,764,731.02 |
| Deferred charges | | 58,929.06 |
| Plants and properties: | | |
| Plants and equipment | $23,124,892.65 | |
| Less depreciation | 6,580,081.10 | |
| | | $16,544,811.55 |
| Land | $ 1,289,494.32 | |
| Less depletion | 114,474.70 | |
| | | 1,175,019.62 |
| Total | | $26,543,491.25 |

LIABILITIES AND CAPITAL

| | | |
|---|---|---|
| Liabilities: | | |
| Accounts payable | $ 71,661.85 | |
| Accrued liabilities | 207,137.69 | |
| Total current liabilities | | $ 278,799.54 |
| 15-year 5% convertible gold debentures outstanding | | 4,146,000.00 |
| Reserves | | 92,161.78 |
| Stock of sub-companies not owned | | 10,976.04 |
| Capital: | | |
| Surplus represented by 458,271 shares of no par value common stock | | 22,015,553.89 |
| Total | | $26,543,491.25 |

EARNINGS STATEMENT OF THE IDEAL CEMENT CO.

| | |
|---|---|
| Net earnings from operation after depreciation and federal income taxes | $274,282.56 |
| Miscellaneous earnings aside from cement manufacture | 404,998.86 |
| | $679,281.42 |
| Less interest paid on debentures | 207,300.00 |
| Balance of net earnings available for surplus and common stock dividends | $471,981.42 |

Equivalent to $1.03 per share on 458,271 shares of no par value common stock outstanding during the year.

## Gypsum, Lime and Alabastine, Canada

EARNINGS of the Gypsum, Lime and Alabastine, Canada, Ltd., Paris, Ont., in 1931 were sufficient to cover interest charges, provision for depreciation and other reserves, and leave a net profit of $39,238. During the year dividends, now suspended, totaling $225,396, were paid, resulting in a deficit for the year of $186,158. After addition of previous surplus, balance brought forward into the current year was $57,936 compared with $244,094 in 1930, and $530,033 in 1929.

Net earnings for the last year were $551,605 compared with $798,382. Interest on mortgage and funded debt was higher, reflecting issuance of additional bonds late in 1930; depreciation and depletion charges were slightly lower but a new item of $50,900 has been deducted as provision for possible loss in foreign exchange and bad and doubtful debts. Net profit was equal to 9c. a share on the common stock, compared with 68c. a share in the previous year.

It is pointed out that though volume of construction in Canada was 46% less in 1931, volume of the company's sales was about 27% less than in 1930. Export business was satisfactory, particularly in Great Britain, where prospects are stated to be good for a substantial increase in sales for the current year.

In his remarks to shareholders, R. E. Haire, president of the company, states that capital expenditures during 1931 principally consisted of $103,878 spent at Beachville, Ont., for electrification of limestone quarries which has had the effect of reducing production costs by at least 25c. a ton. The sum of $59,165 was expended on washing and loading equipment at the Standard Lime Co.'s sand plant at St. Amelie, Que. No major capital expenditures are in prospect for 1932.

Mr. Haire points out that operating expenses have been reduced substantially and providing sales volume for 1932 is as large as it was in 1931 profits for the current year should exceed those for last year.

CONSOLIDATED INCOME ACCOUNT OF GYPSUM, LIME AND ALABASTINE, CANADA, LTD.
(In Canadian currency), years ended December 31

| | 1931 | 1930 |
|---|---|---|
| Operating profit | $ 551,606 | $ 798,383 |
| Depreciation and depletion | 209,387 | 256,828 |
| Balance | 342,219 | 541,555 |
| Interest | 247,582 | 223,665 |
| Federal taxes | 4,500 | 9,525 |
| Other deductions | *50,900 | ..... |
| Net income | 39,237 | 308,365 |
| Dividends | 225,396 | 594,303 |
| Deficit | $ 186,159 | $ 285,940 |
| Times interest earned | 1.38 | 2.4 |
| Earned per share | $0.09 | $0.66 |

Number of shares, 450,876.
*Provision for possible loss in foreign exchange and bad doubtful debts.

CONSOLIDATED BALANCE SHEET OF GYPSUM, LIME AND ALABASTINE, CANADA, LTD.
(In Canadian currency), as of December 31

| Assets: | 1931 | 1930 |
|---|---|---|
| Land, buildings, machinery, etc. | $ 5,932,037 | $ 5,729,541 |
| Mines and development | 3,829,939 | 3,829,869 |
| Investment in subsidiaries, etc. | 133,687 | 128,301 |
| Current assets: | | |
| Cash | 86,426 | 335,601 |
| Call loans | ..... | 150,000 |
| Marketable bonds (cost) | 35,025 | 60,400 |
| Advances to trustees | ..... | 13,168 |
| Cash value life insurance | 21,773 | 17,417 |
| Bills and accounts receivable (net) | 538,243 | 686,262 |
| Inventories | 769,873 | 775,834 |
| Bonds for sinking fund | 99,596 | 8,328 |
| Advances to trustees | 60,979 | ..... |
| Organization expenses, etc. | 314,824 | 334,382 |
| Sundry assets | 60,387 | 59,819 |
| Deferred charges, etc. | 79,329 | 81,059 |
| Total | $11,962,117 | $12,209,983 |
| Liabilities: | | |
| *Capital stock | $ 6,183,393 | $ 6,183,393 |
| Funded debt | 4,338,843 | 4,469,828 |
| Current liabilities: | | |
| Accounts payable and accruals | 194,671 | 200,377 |
| Bank loan | 35,000 | 35,000 |
| Accrued interest | 83,382 | 83,194 |
| Dividend payable | ..... | 90,158 |
| Tax reserve | ..... | 15,650 |
| Deferred liabilities | 25,290 | ..... |
| Reserve for depreciation and depletion | 959,213 | 775,305 |
| Contingent reserves | †15,790 | 30,983 |
| Mortgages payable | 68,600 | 82,000 |
| Surplus | 57,935 | 244,094 |
| Total | †$11,962,117 | $12,209,983 |
| Current assets | 1,451,339 | 2,038,683 |
| Current liabilities | 313,052 | 424,380 |
| Working capital | $ 1,138,287 | $ 1,614,303 |

*Represented by 450,876 no par shares.
†Portion is available for income tax.

## Defers Preferred Dividend

ACTION on the quarterly dividend due July 1 on the 7% cumulative sinking fund convertible first preferred stock, par $100, of the Dufferin Paving and Crushed Stone, Ltd., Toronto, Ont., has been deferred by the directors until such time when it will be possible to determine the operating profits for the current year. The last quarterly payment of $1.75 per share was made on this issue on April 1, 1932.

## Recent Dividends Announced

| | | |
|---|---|---|
| Boston Sand and Gravel pfd. (qu.) | $0.87½, | July 1 |
| Marquette Cement 6% pfd. (qu.) | 1.50, | July 1 |
| McCrady-Rodgers pfd. (qu.) | 0.87½, | June 30 |
| New York Trap Rock 7% pfd. (qu.) | 1.75, | July 1 |
| Southwestern P.C. com. (qu.) | 1.50, | July 1 |
| Southwestern P.C. pfd. (qu.) | 2.00, | July 1 |
| Superior P.C., Cl. A (mo.) | 0.27½, | Aug. 1 |

# Traffic and Transportation

## Proposed Changes in Rates

THE followng are the latest proposed changes in freight rates up to the week ending July 9:

### TRUNK LINE ASSOCIATION DOCKET

29432. **Sand, common or building** (not blast, engine, fire, foundry, glass, molding or silica sand), carloads, and **gravel**, carloads (See note 2), from Boonville, N. Y., and Alder Creek, N. Y., to Verona and Vernon, N. Y., 90c per net ton (See note 5).

29433. **Stone, crushed or broken and stone screenings**, carloads (See note 2), from Bowden, W. Va., and Faulkner, W. Va., to Bartow, W. Va., and Winterburn, W. Va., $1 per net ton (See note 5).

29434. **Crushed stone**, carloads (See note 2), from White Haven, Penn., to Ransom, Penn., 80c per net ton, and **crushed stone and screenings**, carloads (See note 2), from Oaks Corners and Auburn, N. Y., to Ransom, Penn., $1.40 per net ton (See note 5).

29435. To make the following change in Item 65, W. Md. Ry., I. C. C. No. 8219, in connection with local switch movements of **sand, gravel and crushed stone**, carloads, between points within the switching limits of Cumberland, Md.

From Schaidt's Siding (Cumberland), Md., to sidings from team tracks in Cumberland, Md. Proposed rate, *$8.10. Rates in cents per car.

*Applies on traffic that has not had nor will not receive a line haul.

29436. **Stone, natural** (other than bituminous asphalt rock), **crushed**, carloads (See note 2), to East Chatham and Canaan from Feura Bush and South Bethlehem, N. Y., $1, and from New Hamburg, N. Y., $1.10 per net ton (See note 5.)

29438. **Crushed stone**, carloads (See note 2).

| To | Prop. | Prop. | To | Prop. | Prop. |
|---|---|---|---|---|---|
| Milmay | †125 | *115 | Pleasantville | †140 | *125 |
| Hammonton | 125 | 105 | Atlantic City | 140 | 125 |
| Egg Harbor | 125 | 115 | Tuckahoe | 140 | 125 |

†From Trap Rock, Penn., Durham, Penn.
*From Rock Hill, Penn.

Rates in cents per net ton. Reason—Proposed rates are comparable with rates on like commodities for like distances, services and conditions.

29440. **Stone, crushed, coated with oil, tar or asphaltum**, carloads (See note 2), from Martinsburg, W. Va., to Eckhart Junction, Lafferty Siding, Boetcherville, Mt. Savage Junction, Wingerts Siding, Kreigbaum and Ellerslie, Md., $1.30 per net ton. Reason—Proposed rate is comparable with rate to Cumberland, Baltimore, Md., and Washington, D. C.

29451. **Stone, crushed** (not coated), carloads (See note 2), from Buffalo, N. Y., to Mansfield, Penn., $1.50 per net ton. (Present rate $1.75.) (See note 5.)

29456. **Crushed stone**, carloads (See note 2), from Blue Mount, Md., to Washington, D. C., $1 per net ton. (Present rate, $1.15.) Reason—Proposed rate compares favorably with rate from Kearneysville, W. Va., and Martinsburg, W. Va., to Washington, D. C.

29456. Amend Rate Proposal No. 29456 covering rates on **crushed stone**, from Blue Mount, Md., to Washington, D. C., by changing proposed rate of $1 per net ton to read 90c.

29467. **Crushed stone and screenings, natural** (other than bituminous asphalt rock), carloads, in shipping containers loaded on container cars, minimum weight 110,000 lb., from South Bethlehem, N. Y., to Tuckahoe, N. Y., $1.45 per net ton. Proposed rate will include transfer from cars at Tuckahoe, N. Y. Reason: Proposed rate is same as applicable when in ordinary service.

29471. **Crushed stone, coated with oil, tar or asphaltum**, carloads (See note 2), from Syracuse, N. Y., to L. V. R. R. stations. Rates ranging from $1 to $2.05 per net ton. Reason: Proposed rates compare favorably with rate from Jamesville, N. Y.

M-3065. To amend trunk line tariffs naming commodity rates on **burnt or roasted dolomite**, carloads, between points in trunk line territory and from trunk line territory by providing therein the following restriction: "Rates apply on dolomite, roasted (refractory dolomite, in granular form, treated or untreated, clinkered and/or burned to a dead state)."

29313. **Sand, viz., blast, common, engine, glass, molding, quartz, silica and silex**, carload (See note 2) and **ground flint**, carload, minimum weight 40,000 lb., from Western Maryland Ry., Hancock-Round Top district, and B. & O. R. R., Hancock-Berkeley Springs district to Strasburg, O., 14c per 100 lb.; also on **glass sand**, carloads, (See note 2), from Gore-Triplett, Va., to Strasburg, O., $2.95 per net ton.

29473. **Firestone (mica schist)**, carloads, minimum weight 30,000 lb., from Glenside, Ardsley, Somerton, Spring Mill and Wernersville, Penn. Rates in cents per 2000 lb.

| To | Prop. rates |
|---|---|
| Chicago, Ill. | 620 |
| Cleveland, O. | 430 |
| Sandusky, O. | 470 |
| Detroit, Mich. | 470 |
| Dayton, O. | 510 |
| Pittsburgh, Penn. | 360 |
| Michigan City, Ind. | 590 |
| Youngstown, O. | 400 |
| Cincinnati, O. | 530 |
| Charleston, W. Va. | 500 |
| St. Louis, Mo. | 730 |

Reason: Proposed rates are fairly comparable with rates from New Castle, Penn.

29475. **Crushed stone**, not coated), carloads (See note 2), from Buffalo, N. Y., stations to Taintors, Penn., $1.10 per net ton. (See note 5.)

29480. **Crushed or ground soapstone**, carloads, minimum weight 50,000 lb., from Schuyler, Va., to Philadelphia, Penn., $3.45 per net ton.

Sup. 2 to 29321. (a) **Sand, building**, carloads; (b) **sand, blast, engine, molding, ground, flint, quartz and silex**, in straight or mixed carloads (See note 2), from Hancock and Round Top, Md., to Oakfield, N. Y., (a) $2.50 and (b) $2.75 per net ton.

**Note 1—Minimum weight marked capacity of car.**

**Note 2—Minimum weight 90% of marked capacity of car.**

**Note 3—Minimum weight 90% of marked capacity of car, except that when car is loaded to visible capacity the actual weight will apply.**

**Note 4—Reason—To meet motor truck competition.**

**Note 5—Reason—Proposed rates are comparable with rates on like commodities for like distances, services and conditions.**

Sup. 3 to 28309. (a) **Building lime**; (b) **agricultural, chemical, lime and ground limestone**, carloads, minimum weight 30,000 lb., except ground limestone, 50,000 lb., from York, Thomasville and Bittinger to Avis to Patton, Penn., incl., (a) 15½c and (b) 14½c per 100 lb; from Cavetown, Security, Pinesburg, Charlton, Md., and Nessle and Snyder, W. Va., to Hawk Run to Keating, Penn., incl., (a) 17c and (b) 16c per 100 lb.

### CENTRAL FREIGHT ASSOCIATION DOCKET

31999. (Cancels W. D. A. 31447.) To establish on **stone, crushed, slag and/or gravel coated with oil, tar or asphaltum** (Note—The oil, tar and/or asphaltum not to exceed 10% by weight of the commodity as shipped, the shipper to so certify on shipping orders and bills of lading.) carloads, from points in C. F. A. territory to points east of the Western Termini of Eastern Trunk Lines, rating of 16% of first class rates published pursuant to decision in I. C. C. Docket 15879.

32000. (Cancels W. D. A. 31447.) To reduce commodity description published in agency and individual lines' tariffs naming specific commodity rates on **stone, crushed, coated with oil, tar or asphaltum**, carloads, between points in C. F. A. territory, also from points in C. F. A. territory to arbitrary territory east of Pittsburgh, Penn., as described in C. F. A. L. Tariff 130-U, to read as follows: "Stone, crushed, slag and/or gravel, coated with oil, tar or asphaltum (See note), carloads (See note 3). Note—The oil, tar and/or asphaltum not to exceed 10% by weight of the commodity as shipped, the shipper to so certify on shipping orders and bills of lading."

31993. To establish on **gravel**, carloads, from E. St. Louis, Ill., and St. Louis, Mo., to Cote St. Paul (Montreal), Quebec, Canada, $7.80 per net ton. Present—Classification basis.

32024. To establish on **crushed stone, coated with tar or asphaltum**, carloads, from Jackson, O., to McArthur, Creola, Orland, O., 76c; New Plymouth, Starr, Union Furnace, Logan, Athens, Vinton, Bidwell, Kerrs, Gallipolis, O., 91c; Lancaster, Sugar Grove, Haydenville, Nelsonville, Middleport, O., 99c; Pomeroy, O., 106c, and Radcliff, O., *84c per net ton. Present—McArthur, Creola, O., 96c; Orland, New Plymouth, Starr, Union Furnace, Radcliff, Vinton, O., 107c; Lancaster, Athens, Middleport, Pomeroy, O., 130c; Sugar Grove, Logan, Haydenville, Nelsonville, Bidwell, Kerrs, Gallipolis, O., 119c per net ton, as per C. & O. Ry. F. T. B-2180, Ohio No. 1284.

*Item 2690 provides when sixth class 11c per cwt. the rate will be 87c per net ton.

32064. To establish on **sand** (except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica) and **gravel**, carloads, from Sandusky, O., to points in Ohio shown below.

| To (representative Ohio points) | Prop. | Pres.* |
|---|---|---|
| Alexandria, N. Y. C. delivery | $1.20 | †$1.40 |
| Ashtabula, N. Y. C. delivery | 0.90 | 1.20 |
| Avon, N. K. P. delivery | 0.80 | †0.90 |
| Brownhelm, N. Y. C. delivery | 0.60 | †0.70 |
| Burghill, Erie delivery | ¶1.25 | †1.75 |
| Coleman, Erie delivery | ¶1.25 | (§) |
| Coshocton, W. & L. E. delivery | 1.00 | †1.40 |
| Danbury, N. Y. C. delivery | 0.50 | †0.60 |
| Earlville, P. R. R. delivery | 0.90 | †1.20 |
| Elyria, N. Y. C. delivery | 0.70 | 0.80 |
| Fremont, N. Y. C. delivery | 0.80 | 0.70 |
| Granville, N. Y. C. delivery | 1.20 | †1.40 |
| Johnstown, N. Y. C. delivery | 1.20 | †1.40 |
| Latimer, N. Y. C. delivery | 1.35 | †1.50 |
| Lemert, N. Y. C. delivery | 0.90 | †1.10 |
| Martel, C. C. C. & St. L. delivery | 1.00 | †1.10 |
| Minerva, W. & L. E. delivery | 1.10 | †1.50 |
| Mt. Gilead, N. Y. C. delivery | 1.00 | 1.10 |
| Norwalk, N. Y. C. delivery | 0.70 | 0.80 |
| Peerless, N. Y. C. delivery | 1.10 | †1.40 |
| Port Clinton, N. Y. C. delivery | 0.50 | 0.60 |
| Sherrodsville, W. & L. E. delivery | 1.20 | †1.50 |
| Spencer, W. & L. E. delivery | 0.70 | †1.20 |
| Toledo, N. Y. C. delivery | 0.60 | 0.90 |
| Unionville, N. Y. C. delivery | 0.90 | †1.20 |
| Warren, Erie delivery | 1.00 | 1.50 |
| Wellington, W. & L. E. delivery | 0.70 | 0.90 |
| Wickliffe, N. Y. C. delivery | 0.90 | 1.00 |
| Zanesville, N. Y. C. delivery | 1.25 | 1.40 |
| Zoar, W. & L. E. delivery | 1.10 | †1.50 |

Explanation of reference marks:
*Present rate on sand per N. Y. C. I. C. C. L. S. 1413.
†Intermediate rate, not specifically published.
§Sixth class rate.
¶Applies via N. Y. C. R. R., Cleveland, O., and Erie.

32095. To establish on **spent or refuse grinding sand**, carloads, from Butler, Penn., to Port Clinton, O., rate of 170c in open top equipment and 196c per net ton in box cars, subject to emergency charge. Present—420c per net ton, subject to emergency charge.

32097. To establish on **stone, crushed and crushed stone screenings** (in bulk, in open top cars), carloads, from Painesville and Perry, O., to Mentor, Willoughby and Wickliffe, O., rate of 50c per net ton. Present, 60c per net ton. Rate to Mentor, O., intermediate to Willoughby.

32096. To establish on **sand** (lake, river and bank, other than sand loam), carloads, in open top equipment, from Gary, Miller (Lake Co.) and Willow Creek, Ind., to Decatur, 139c; Litchfield, 151c; Quincy, 177c; E. St. Louis, Ill., 189c; St. Louis, Mo., 189c; Springfield, Ill., 139c per net ton. Present rates—176c to Decatur, 189c to Litchfield, 214c to Quincy, E. St. Louis, Ill., St. Louis, Mo.; 189c to Springfield, Ill.

32054. To establish on **crushed stone**, carloads, in open top cars, from Marion, O., to Little Hocking, Porterfield and Belpre, O., rate of 110c per net ton via C. & O. Ry., Athens, O., and B. & O. R. R. Present—18c.

32055. To establish on **sand** (except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica) and **gravel**, carloads, from Wolcottville, Ind., to Wabash, Ind., rate of $1.05 per net ton (subject to emergency charge), via P. R. R., Fort Wayne, Ind., I. S. Corp. Present—Classification basis.

32056. To establish on **agricultural limestone, unburned; stone, crushed; stone screenings**, in straight or mixed carloads, in bulk or open top cars, from Centerville, O., to Connersville, Ind., rate of 110c per net ton (subject to emergency charge), via P. R. R., Middletown, O., B. & O. R. R. Present—Classification basis.

32057. To establish on **sand and gravel**, carloads, in open top equipment, minimum weight,

from Steubenville, O., to Fair Play, O., rate of 60c per net ton (emergency charge not included). Present—70c per net ton.

32058. To establish on **sand and gravel**, carloads, in open top equipment, from Massillon, O., to Jefferson, O., rate of 115c per net ton (subject to emergency charge). Present rate—140c.

32059. To establish on **sand and gravel**, carloads, in open top equipment, from Circleville, O., to Washington Court House, O., rate of 60c per net ton (emergency charge not included). Present—65c.

32061. To establish on **crushed stone and crushed stone screenings**, carloads, from Narlo, O., to South Bend, Ind., rate of 145c per net ton, via N. K. P., Ft. Wayne, Ind., N. Y. C. R. R., subject to emergency charge of 6c per net ton. Present—150c, subject to emergency charge of 6c.

32062. To establish on **stone, crushed, limestone, unburned, agricultural**, in bulk, in open top cars, carloads, from Bloomville, O., to Shiloh, O., rate of 70c per net ton, via P. R. R., Vernon, O., C. C. C. & St. L. Ry. Present—80c.

32068. To establish on **crushed stone**, in open top cars, from McVitty's, O., to North Randall, O., rate of 100c per net ton (emergency increase in addition). Present, 18c (classification basis, sixth class).

32086. To establish on **crushed stone and crushed stone screenings**, in open top cars, carloads, from McVitty's, O., to Detroit, Mich., rate of 90c per net ton, to apply to Michigan Central R. R. deliveries only (emergency increase in addition. Present—110c. (Emergency increase in addition.)

32090. To establish on **sand and gravel**, carloads, from Geauga Lake and Mantua, O., to Painesville, Wickliffe and Willoughby, O., rate of 75c per net ton for N. Y. C. & St. L. R. R. delivery. Present—90c to Painesville, 80c to Wickliffe and 85c to Willoughby, O.

32070. To establish on **gravel and/or crushed stone**, to which has been added **oil, tar or asphalt** in the amount to form more than 2% but not more than 9% of the whole mixture, carloads, from South Lebanon, O., to Berea, Ky., rate of 240c per net ton (subject to emergency charge), via P. R. R., Cincinnati, O. Present rate—classification basis.

32131. To establish on (a) **sand**, other than blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding and silica, carloads, to Mercer, Penn., from Clairton, Duquesne, Wharf, Munhall, South Duquesne, Penn.; (b) **slag**, commercial, crushed, carloads, to Mercer, Penn., from Clairton, Duquesne, South Duquesne, Bessemer, Briquette, Homestead, Mifflin Junction, North Bessemer, Rankin, Wylie, Penn., rate of 90c per net ton, plus emergency charge. Present rates—100c on both sand and slag.

32143. To cancel rate of 50c per net ton on **crude magnesite**, carloads, minimum weight 80% of marked capacity of car, from Hays, Penn., to South Duquesne, Penn., as published in P. R. R. Tariff G. O. I. C. C. 14144, account obsolete.

32147. To establish on **crushed stone**, carloads, from Melvin, O., to Canaanville, O., rate of 90c per net ton. Present—100c.

### SOUTHWESTERN FREIGHT BUREAU DOCKET

25107. **Lime**, from Missouri points and Johnsons, Ark., to Radley and Frontenac, Kan. To establish the following rates per 100 lb. on lime, carloads, from and to points shown below: From Group 1—Ash Grove, Galloway, Osceola, Pierce City, Sequiota and Springfield, Mo.; Group 2—Johnsons, Ark., to (A. T. & S. F. Ry.) Radley and Frontenac, Kan., Group 1, 11½c; Group 2, 13c. The proposed rates are those in effect from competitive points via Missouri Pacific. Proponent desires to meet the rates of the Missouri Pacific and be on a competitive basis.

### WESTERN TRUNK LINE DOCKET

403-L. **Lime**, carloads, from Mosher and Ste. Genevieve, Mo., to Mitchell, S. D. Rates, present, 38½c, minimum weight 60,000 lb.; 40½c, minimum weight 30,000 lb., Chicago combination; proposed, 31½c, minimum 30,000 lb.

8024. Rates, **rock, silica sand, ground and powdered**, carloads (See note 3). In no case shall the minimum weight be less than 40,000 lb., from Ottawa, Utica, Ill., district to Kansas City, Mo.-Kan. Rates, present, 15½c per cwt.; proposed, 270c per ton of 2000 lb.

Sup. 1 to 4781-J. Rates: **Rock, bituminous asphalt**, carloads, minimum weight 80,000 lb., except that when car of less capacity is used for carrier's convenience actual weight to apply, but not less than 60,000 lb., from Liberal, Lamar, Nevada, Mo., and Pleasanton, Kan., to Audubon, Carson, Cumberland, Griswold, Guthrie Center, Harlan, Indianola, Knoxville, Washington, What Cheer and Winterset, Ia. Rates: Present—Class or combination basis. Proposed—To establish $3 per ton of 2000 lb., plus emergency tariff charge.

### ILLINOIS FREIGHT ASSOCIATION DOCKET

3339-A. **Crushed stone, coated with oil, tar or asphaltum** (known as amesite or carborock), (See note 3) from Chicago to points in Illinois. Present—Various. Proposed—Same rates as apply on crushed stone.

6128-A. **Sand gravel**, carloads (See Note 1), from Grayville, Ill., to Olney, Ill. Present—76c per net ton. Proposed—65c.

6693. **Crushed stone**, carloads, as named in Alton R. R. Tariff 1400T, Ill. C. C. 931, from Joliet, Ill., to stations on Alton R. R., viz.: Middletown, Croft, Fancy Prairie and Van Wood, Ill. Present—$1.26; proposed, $1.01 per net ton.

6694. **Sand and gravel** carloads (See note 3), from Allison Branch, Ill.

| To | Pres. | Prop. |
|---|---|---|
| Pawnee, Ill. | (*) | $1.26 |
| Sicily, Ill. | (*) | 1.26 |
| Humphrey, Ill. | (*) | 1.26 |

*Classification basis.

6695. **Sand and gravel**, carloads (See note 3), from Allison Branch, Ill. (rates per net ton).

| To (representative) | Pres. | Prop. |
|---|---|---|
| Boulder, Ill. | (*) | $1.13 |
| Litchfield, Ill. | (*) | 1.26 |
| Virden, Ill. | (*) | 1.39 |
| Franklin, Ill. | (*) | 1.51 |
| Mermet, Ill. | (*) | 1.49 |

*Classification basis.

6698. **Sand and gravel**, carloads, as named in Alton R. R. Tariff 1401-T. Ill. C. C. 932 (See note 3), but in no case will the minimum weight be less than 60,000 lb., from Joliet, Ill., to Lintner, Ill. Present—Combination. Proposed—$1.13 per net ton.

6639-A. **Agricultural limestone**, carloads, minimum weight 60,000 lb., from Elmhurst and Quincy, Ill., to connecting lines in I. R. C. territory. Present—Crushed stone basis. Proposed—20c per net ton over Chicago, Ill., rate.

6701. **Crushed stone**, carloads, usual minimum weight, from East St. Louis and Falling Springs, Ill., rates per net ton. To representative points.

| | Prop. |
|---|---|
| Bement, Ill. | $1.01 |
| Voorhies, Ill. | 1.13 |
| Lanton Spur, Ill. | 1.26 |
| Altamont, Ill. | 1.26 |

Present, class rates.

6706. **Sand, viz., blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, molding or silica**, carloads (See note 3), but not less than 40,000 lb., to Marseilles, Ill. Rates in cents per net ton.

From Ottawa, Ill.: present, 63c plus 6c emergency; proposed, 50c plus 5c emergency.

From Utica, Ill.: present, 70c plus 6c emergency; proposed, 60 plus 5c emergency.

6711. **Ground slag or ground slag and ground limestone mixed** (See note 2), from Buffington, Ind.:

To Lockport, Ill.: present, limestone, 7c per 100 lb.; slag, $1.10 net ton; proposed, 85c net ton.

To Marseilles, Ill.: present, limestone, 9c per 100 lb.: slag, $1.36 net ton; proposed, 90c net ton.

To Wilmington, Ill.: present, limestone, 7c per 100 lb.: slag. $1.36 net ton; proposed, 90c net ton.

To Vandalia, Ill.: present, limestone, 13c per 100 lb.; slag, $2.24 net ton; proposed, $1.39 net ton.

East St. Louis, Ill.: present, limestone, $2.02 net ton; slag, $1.39 net ton; proposed, $1.39 net ton.

6718. **Sand and gravel**, carloads (See note 1), from Merom, Riverton, Ind., to Olney, Ill. Present, 84c; proposed, 70c per net ton.

6721. **Sand**, carloads, minimum weight as described in Item 3730 of Agent C. W. Galligan's Freight Tariff No. 33, I. C. C. 154, from Ottawa, Ill., to Belleville, Ill. Present, $1.64; proposed, $1.39 per net ton.

## I. C. C. Decisions

**14620. Agricultural limestone,** ground or pulverized, from Waukesha, Wis. (Fourth section application.) Carriers authorized to establish and maintain rates over indirect routes from Waukesha, Wis., to competitive destinations, lower peninsula of Michigan and Michigan City, Ind., equal to lowest rates applicable over any line or route, from and to the same points, constructed on the basis of distance scales prescribed or approved in Smelter vs. Ann Arbor, 178 I. C. C. 324, and to maintain higher rates from and to intermediate points, provided they observe the lowest combination and 50 and 70% circuity limitation and rules. Authority granted in fourth section order No. 10964.

## Proposed I. C. C. Decisions

**24936. Crushed sandstone.** O. A. Smith Agency, Inc., vs. I. C. et al. By Examiner Brown. Reparation recommended on finding that rates, crushed sandstone with 2 or 3% natural bituminous content, Big Clifty, Ky., to Ironton, Ohio, and Milwaukee, Wis., were unreasonable to extent they exceeded $2.10 to Ironton and $2.45 to Milwaukee.

## Court Defines Crude Gypsum

GYPSUM ROCK crushed for convenience in transportation and unsuited for use without further processing is still in the crude state and is entitled to free entry into the United States, the United States Court of Customs Appeals has decided. Originating under the Tariff of 1922, the suit was first tried in the Customs Court on protest of the Gulf Gypsum Co., a domestic concern, claiming that gypsum of the kind imported had been subjected to a crushing or grinding process in Canada and was dutiable at one of several provisions as a manufactured product. The protest was overruled and on appeal the judgment is sustained.

In the opinion written by Justice Garrett it is noted that within recent years machinery has been resorted to for crushing the gypsum rock as quarried. Formerly sledge hammers wielded by hand were used to break it into sizes for shipment, but Justice Garrett says the change in method did not bring about a step in manufacture, but produced only smaller and more uniform sizes. The material was no nearer condition for ultimate use than before, he added. Treasury Department rulings of 1875, holding ground gypsum rock dutiable, are of no importance, it is concluded, because crushing by machinery was not the practice then and the materials ruled on could not have been the same.

## Canadian Plant Makes Large Export Shipment of Superphosphate

A RECORD SHIPMENT of fertilizer from the Consolidated Mining and Smelting Co. of Canada, Ltd., at Trail, B. C., was to be made through the Port of New Westminster early in July.

The shipment, comprising 140 carloads, is consigned to the Hawaiian Islands and will form a 6000-ton cargo.

Substantial shipments of the Trail product, which is rapidly making a name for itself in the fertilizer field, have been handled through the port of New Westminster for some time, but this shipment is several times larger than any previous consignment shipped from New Westminster.—*New Westminster* (B. C.) *British Columbian.*

[This plant has used large quantities of phosphate rock from Montana in producing superphosphate.—The Editor.]

# Foreign Abstracts and Patent Review

**Hydration of Aluminate of Lime in Portland Cement.** K. Koyanagi studied the action of gypsum in the hydration of aluminate of lime in portland cement. He has isolated, pure, the sulpho-aluminate of calcium from portland cement clinker and gypsum and determined its chemical composition exactly. From the experimental data presented it appears that in the hydration of portland cement, gypsum binds aluminate of lime from cement and forms sulpho-aluminate of calcium of the composition $3CaO \cdot Al_2O_3 \cdot 3CaO_4 \cdot 32.6\ H_2O$. The sulpho-aluminate of calcium, which contains less than three molecules gypsum, does not arise in the hydration of portland cement. In time the sulpho-aluminate of calcium disintegrates in solution back into gypsum and aluminate of lime.—*Zement* (1931) **20**, 48, pp. 1016-1021.

**Mortar Characteristics of Tricalcium Silicate.** Haegermann concludes from experiments on the mortar characteristics of tricalcium silicate that 1 mole $SiO_2$ fixes 3CaO, is absolutely consistent in volume, remains sluggish in hardening and fixes slowly. The characteristic rapid fixing of portland cement is called forth by the presence of alumina. If the alumina in cements is fully replaced by ferric oxide, slow-setting, sluggish hardening binding agents are obtained.—*Tonindustrie-Zeitung* (1931) **55**, 102, p. 1420.

**Observations on Rotary Kiln Linings.** H. Kuehl, H. Lorenz and F. Thilo present the results of observations made on the linings of a rotary cement kiln immediately after shutdown. Many surprising observations were made in this investigation showing that distillation processes in the kiln lining are caused not only by the halogen compounds, but also by other new formations that come under consideration here. The kiln under discussion was 30 m. long and 2 m. in diameter, lined with fireclay (chamotte) lining which lasts about six months in the sintering zone and two years elsewhere. At the time of shutdown it had worn to about 5 cm. thickness. A somewhat sulphur-bearing coal was fired and no fluxing material was used in the raw mix. The clinker ashes and chamotte gave the analysis below:

| | Clinker—average | Ash—average | Chamotte—approximate |
|---|---|---|---|
| Loss on ignition | 0.24% | ..... | ..... |
| Silicic acid | 22.34% | 44.77% | 52% |
| Alumina | 6.57% | 28.80% | 43% |
| Iron oxide | 1.86% | 16.14% | 2% |
| Lime | 66.78% | 1.44% | ..... |
| Magnesia | 0.91% | 0.76% | ..... |
| Sulphuric acid anhydride | 0.52% | 2.28% | ..... |
| Alkalies (difference) | 0.68% | 5.81% | ..... |

Fifteen samples of deposits were taken from the kiln lining at different sections and each analyzed, classified in groups corresponding to kiln inlet, calcining zone, sintering zone, discharge zone and kiln lining. The samples are described in detail, the reasons for their formation given and the results of the analyses presented in tables. The following determinations were made including the conclusions arrived at:

Red crusts formed in the inlet tube of the kiln, which consist of iron oxide and iron sulphate. Red masses of deposit which covered the walls of the flue contain besides cement materials, ashes, alkalies and sulphuric acid, also excess quantities of alumina and iron oxide.

In the entire range of the calcining and sintering zone an intermediate layer with a high content of alkalies and alkali sulphates formed between the deposit and the chamotte lining; the wear of the lining can likely be traced to its influence. As in the flue, so in the calcining zone there are local deposit accumulations of alumina and iron oxide; and parts of the lining next to them show an impoverishment of alumina, demonstrating the possibility of travel of the sesquioxides.

In the deposit near the kiln outlet are nests with a high content of silicic acid and alkalies; it appears as if here liquation processes have played a role—conditioned perhaps through the departure of sesquioxides and the receiving of larger quantities of alkali. The deposit in the sintering zone contains all around a pure white to greenish white intercalation, which consists essentially of cement material from which the iron compounds have practically completely disappeared. The formation of iron-halogen or iron carbonyl compounds does not come into consideration as an explanation; also the reduction to metallic iron is very improbable. The possibility is discussed that the iron is distilled off as iron sulphide.

In the chamotte lining and between the chamotte lining and the kiln casing there are deposits of iron oxide and formations of iron sulphate in the discharge zone, formations of iron bisulphate in the sintering zone; their origin has some connection with the disappearance of the iron from the deposit in the sintering zone.

The observations lead to the recognition that for the wear of the kiln lining not only reactions between lining, cement material and ashes come in consideration, but that an important role is played here also by reactions with the gas phase as such and also with distillation processes and condensation processes.—*Zement* (1931) **20**, Nos. 39, 40.

**Zeolites and Hydraulic Binders.** H. Lafuma reviews first the findings of investigators of zeolites, hydrated salts of cements, aluminates of hydrated calcium, sulpho-aluminates of calcium, silicates of hydrated calcium and hydrate of lime. Then, with support from investigators, he discusses the theory of hydraulicity in the second part of his article, specifically the theory of adhesion, crystalloids and colloids and the theory of shrinkage.—*Revue des Materiaux de Construction et de Travaux Publics* (1931) *Nos.* 256 and 257.

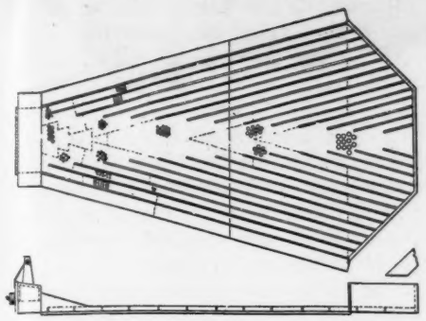
## Recent Process Patents

*The following brief abstracts are of current process patents issued by the U. S. Patent Office, Washington, D. C. Complete copies may be obtained by sending 10c to the Commissioner of Patents, Washington, D. C., for each patent desired.*

**Volatilizing Phosphorus and Simultaneously Producing Cement.** The inventors say that melting phosphate rock and added ingredients to make a slag resembling portland cement produces some calcium carbide on account of the high lime present and that this is a most undesirable constituent. By melting down a mix containing 40 to 50% of lime they have found that a slag is produced which makes an excellent cement when ground with portland cement clinker, and all the phosphorus will be completely volatilized so that it can be recovered.

An electric or shaft furnace may be employed and carbon may be used as the reducing agent. Examples of several mixtures for melting are given. These all include raw phosphate rock and coke and some include clay and some bauxite. One mix includes aluminum phosphate (Saladana phosphate). The mix covered by the patent is about 16.5 to 18.7% $Al_2O_3$, 30.8 to 33.5% $SiO_2$ and 40 to 50% CaO. Using aluminum phosphate of the given composition, 76.4 parts are mixed with 105 parts of calcium phosphate containing 47.3% CaO and 35.1% $P_2O_5$. *Gustav Pistor, Robert Suchy and Emil Reubke, assignors to Farbenindustrie Aktiengesellschaft, Frankfort O. M., Germany, U. S. Patent No.* 1,826,433.

**Dry Separator.** This invention is a dry separating or concentrating table, but the inventor claims that feed does not have to be closely screened, as is necessary with some other forms. An illustration shows the table top in plan. Material is introduced



*Plan and section of table top*

at the broad end and is worked toward the small end by giving the table a reciprocating motion. The top of the table is made of canvas or similar material. The space below this top is divided into compartments and air is blown into these compartments through perforated plates. The perforations at the feed end are largest so that the air pressure is greater there and decreases toward the small end. The motion and the varied air currents stratify the bed of material on the table top. As this stratified bed works forward the heavier material on the bottom is guided by the riffling strips to the center channel. The lighter material works over these strips and falls off the sides of the table. An additional cleaning is given the heavy material as it is discharged by blowing air through it to lift out stray light pieces. *Kenneth Davis, assignor to Peale-Davis Co., Wilmington, Del., U. S. Patent No.* 1,819,996.

**Accelerating the Hardening of Plastic Materials.** Inventor claims that passing an electrical current through freshly poured concrete will accelerate its hardening. Where reinforcing is used the reinforcing bars will serve as the electrodes; in other cases the electrodes must be cast in the concrete. Heat is generated in the mass and as the hardening proceeds the electrical resistance constantly increases, therefore the resistance at any moment will indicate the degree of hardening. If the current flows more easily through one part of the mass than the remainder that part will harden first, the resistance will be increased and the current thus directed to other parts thus making the process self regulating and tending to create an even temperature throughout the mass. The inventors claim that 70% of the full 28 day strength has been reached in a few hours by the application of an electrical current in this way.—*Albert Brund and Helge Bohlin, Sweden, U. S. Patent No.* 1,808,762.

**Wall Plaster.** A patent previously issued covers a plaster made with calcined gypsum and coarsely ground raw gypsum. Sand has been added to this, but unscrupulous builders have added too much. In case of failure it has been difficult to fix the blame. The inventor therefore adds dried and ground shale which is available only at the plaster mine. Any adulteration with sand is easily detected. The dried and ground shale may also be used with calcined gypsum alone. Examples of mixtures are given:

EXAMPLE 1

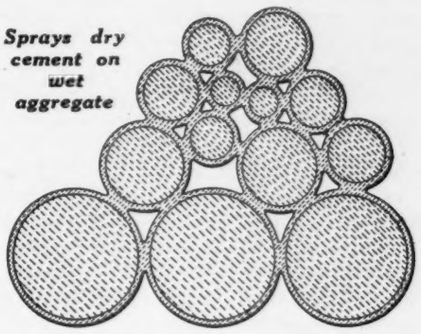
| | |
|---|---|
| Fine calcined gypsum—under 100-mesh | 20% |
| Coarse gypsum—over 40-mesh | 20% |
| Coarse gypsum—over 60-mesh | 25% |
| Coarse gypsum—over 100-mesh | 15% |
| Shale—over 40-mesh | 20% |

EXAMPLE 2

| | |
|---|---|
| Commercial calcined gypsum containing 100-, 80- and 60-mesh | 25% to 33⅓% |
| Shale—over 40-mesh | 75% to 66⅔% |

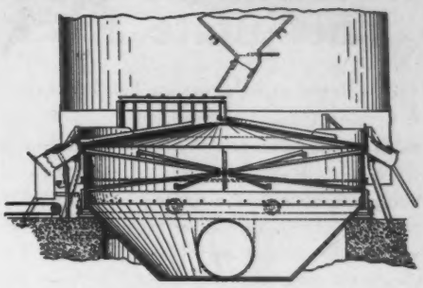
Other materials and coloring matter may be added to obtain special properties.—*Gordon R. Walper, U. S. Patent No.* 1,803,445.

**Method of Producing Porous Concrete.** The method consists in coating each particle of aggregate thinly with cement paste so that the particles will stick together leaving air spaces in the voids. The cement paste may be sprayed on as a slurry, but the inventor prefers to have the aggregate as wet as possible and then to spray on dry cement which will combine with the moisture held by the




aggregates. In the case of slag, haydite and other porous materials, the pores will hold sufficient water. For other materials the aggregate may be coated in an atmosphere of live steam. The patent shows apparatus for doing this.—*Karl P. Billner, assignor to Aerocrete Corp. of America, New York, U. S. Patent No.* 1,823,343.

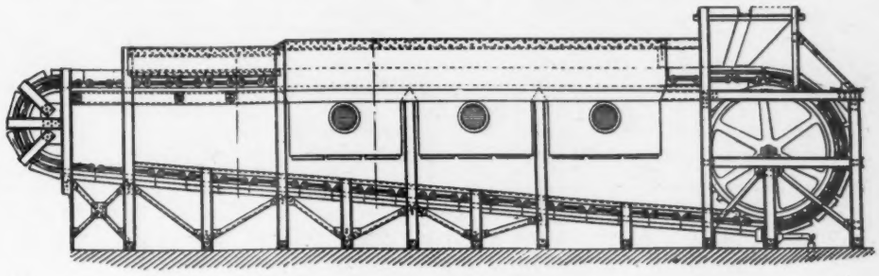
**Separating Mixed Dry Materials.** The inventor claims this method separates as much by size as by specific gravity so the close screening usually required as a preliminary to dry separation is not necessary. The device consists of a conoidal table made of pervious material such as canvas. The table is revolved slowly and air is blown through the pervious top from below. The material to be separated is fed to the center



*Air current through cloth stratifies material*

of the table and the motion and the air rising through the cloth works it toward the edge and stratifies it. Arms loosen the material at the start. The table top becomes less pervious toward the edge. The effect of the actions of air and motion is to maintain a bed of material on the table having the smaller, lighter materials on top and the coarser, heavier materials on the bottom. Metal strips keep the heavier grains working toward one discharge point on the periphery while the lighter grains pass over the metal strips to another discharge point. *Richard Peale, assignor to Peale-Davis Co., Wilmington, U. S. Patent No.* 1,812,365.

**Process of and Apparatus for Heat Treating Alkaline Earth Carbonate and Other Materials.** This, from what is said in the specifications, is primarily a lime kiln. It consists of a series of pallets made of refractory material which are carried over pulleys as are the pans in a pan conveyor, and they pass through a heating chamber where the material they carry is burned. Before receiving the charge of limestone each pallet is sprinkled with a heat resisting material to protect it in the furnace. This material may be separated from the burned lime and sent back to a hopper above the pallets for reuse. After getting its charge of limestone the pallet goes into the heating chamber, which is heated by having the hot gases of a furnace drawn through it by a fan. Then it goes to a soaking zone where it cools very slowly to give a chance for the heat treatment to be completed. This conserves heat and requires less fuel than if the material were to be cooled quickly. Another saving of fuel may be made by preheating the material. This is done in a chamber which receives the hot gases which have passed the heating chamber. *Reed W. Hyde, assignor to Dwight and Lloyd Metallurgical Co., New York, U. S. Patent No.* 1,810,313.



*Refractory pallets convey material through burning zone*

# Phosphate Rock Industry in 1931

IN 1931 the phosphate rock industry in the United States reversed its previous upward trend, according to the United States Bureau of Mines. Reports of producers of phosphate rock in the United States in 1931 reveal that, as compared with 1930, there was a curtailment of 41% in demand for phosphate rock produced during the year for consumption in the United States, and a decrease of 23% in demand for domestic rock for export. Total mine production and shipments fell 35% below the relatively high record made in 1930, and the total value of all domestic phosphate rock sold in 1931 dropped 34% as compared with 1930. Foreign demand likewise declined in 1931.

Total shipments of Florida rock were less in quantity than for any year since 1922 and the value was lower than for any year since 1918. Shipments of Florida hard rock, which with few reactions have pursued a downward trend since 1907, declined to a point which was the lowest of any year for which figures have been recorded by the Bureau of Mines, with the exception of 1915 to 1917 inclusive. Land-pebble shipments from Florida, which have grown from a minimum of about 155,000 long tons in 1898 to a maximum of about 3,166,000 tons in 1930, and which were over 2,000,000 tons from 1923 to 1928, inclusive, and exceeded 3,000,000 long tons in 1929 and 1930, dropped in 1931 to a point slightly above that of 1922, when about 1,870,000 tons were shipped.

With one exception (1921) the total quantity of brown and blue rock sold in Tennessee in 1931 was less than for any year since 1909, and the value was the lowest since 1916.

Conditions in the Western States, however, showed noteworthy improvement as compared with all previous years. This field, which was discovered in 1906, and which at present commercially comprises Idaho, Montana and Wyoming, showed gains in shipments which exceeded the former banner year of 1925 by 79% in quantity and 69% in value. As compared with 1930, the quantity and value sold showed increases of more than 90 and 100%, respectively.

### Production

The quantity and value, by states, of the various kinds of phosphate rock sold or used by producers in 1930 and 1931, the average value per ton, and the amount of stocks on hand December 31, for those years, were as follows:

### Florida

Florida outranked all other states, as usual, in both quantity and value of phosphate rock marketed in 1931. Total shipments amounted to 81.3% of the total phosphate rock sold or used by producers in the United States in 1931, as compared with 82.7% in 1930. The record for total tonnage shipped from this state in 1931 declined to the 1923 level, and the value was lower than for any year since 1918. In comparison with 1930 the figures indicate decreases in total shipments of 37% in quantity and 33% in value. Land-pebble phosphate rock constituted 96.5% of the total quantity of Florida phosphate rock marketed or used by producers in 1931, hard rock phosphate comprised 2.8%, and soft rock comprised the remaining 0.7%. The total amount of phosphate rock exported from Florida in 1931 (822,701 long tons) constituted 39.9% of the total marketed production of this state, and indicated a decrease of 29.9% as compared with 1930. The total marketed production for consumption in the United States (1,238,765 long tons) decreased 40.3% in quantity as compared with 1930. Of the total marketed production for domestic consumption, about 86% was sold for use in the manufacture of superphosphates as compared with 91% in 1930.

In 1931 three kinds of phosphate rock were commercially mined in Florida—hard rock, soft rock, and land pebble.

*Hard Rock*—The total marketed production of hard rock in Florida in 1931 was mined in Citrus county by three producers—J. Buttgenbach and Co., Dunnellon; C. and J. Camp, Ocala, and the Mutual Mining Co., Savannah Ga. Declines of 30% in quantity and 26% in value were recorded. Of the total (57,224 long tons), 42,782 tons, or 74.8%, was exported, compared with 78% in 1930. The remainder was sold for consumption in the United States.

*Soft Rock*—Soft rock, from Polk county, was shipped by the Lakeland Phosphate and Fertilizer Co., Bartow. In addition, a commercial production obtained from "waste pond" operations in Citrus county was reported by two new producers, the American Phosphate Corp., Jacksonville (succeeded in 1932 by the Colloidal Phosphate Sales Co., Dunnellon), and Connell and Shultz, Inverness. The product, which is dried, ground and screened, is used as a fertilizer filler and for direct application to the soil.

*Land Pebble*—The total quantity of land-pebble rock sold or used in 1931 constituted 96.5% of the total marketed production of land pebble in the state in 1931, as compared with 97.5% in 1930. In comparison with 1930, decreases of 37% in quantity and 34% in value were recorded. The production was mined in Polk county by seven producers, the same number and personnel as in 1930. Approximatey 63% of the land-pebble shipments in 1930 (1,990,806 long tons) was consumed in the United States, and 37% (733,850 tons) was exported.

### Tennessee

Sales of brown and blue rock in Tennessee in 1931 amounted to 343,622 long tons, valued at $1,545,607. By far the larger part of the production was brown rock from Maury county. As compared with 1930, these figures indicate decreases of 43.8% in quantity and 47.4% in value. The compilations also reveal that more than half of the marketed production was sold for use in the manufacture of superphosphates.

### Western States

Increased mining activities in the Western States, principally in Montana, were responsible for the peak of commercial production being reached in 1931. The greater part of the output was shipped to Trail, B. C., for use in the manufacture of superphosphates.

*Idaho*—The commercial production in Idaho of 60,978 long tons, valued at $234,781, was made by three producers—the Agricultural Potassium Phosphate Co., Paris (a new operator); the Anaconda Copper Mining Co., Conda, and the Solar Development Co., Ltd., Trail, B. C.

*Montana*—In 1931 the marketed production of phosphate rock in Montana increased many times in both quantity and value over that of 1930, due principally to the greatly increased production of the Anderson mine in Powell county by William Anderson, Garrison. One new operator was reported—the Northwest Improvement Co., Elliston. In addition to the marketed production reported by these two operators, a small output was reported by Dissett Bros., whose property is in Granite county, near Philipsburg.

| | Mine production (long tons) | Shipments | Value | | Stocks | |
|---|---|---|---|---|---|---|
| | | Long tons | Total | Average | Dry Long tons | Wet Long tons |
| Florida: | | | | | | |
| Hard rock | 23,164 | 57,224 | $ 380,540 | $6.65 | *28,487 | 7,610 |
| Land pebble | 2,039,221 | 1,990,806 | 6,756,428 | 3.39 | 145,623 | 551,647 |
| Soft rock | 14,418 | 13,436 | 65,118 | 4.85 | (†) | ..... |
| 1931 | 2,076,803 | 2,061,466 | $7,202,086 | $3.49 | 174,110 | 559,257 |
| 1930 | 3,261,539 | 3,248,071 | 10,790,305 | 3.32 | 186,675 | 611,304 |
| Idaho (Western rock): | | | | | | |
| 1931 | 61,769 | 60,978 | 234,781 | 3.85 | 1,774 | 192 |
| 1930 | 64,129 | 59,932 | 234,543 | 3.91 | 1,890 | 161 |
| Montana (Western rock): | | | | | | |
| 1931 | 67,893 | 67,893 | 301,511 | 4.44 | ..... | ..... |
| 1930 | 6,005 | 6,005 | 27,457 | 4.57 | ..... | ..... |
| Tennessee (Brown and blue rock): | | | | | | |
| 1931 | 370,070 | 343,622 | 1,545,607 | 4.50 | 47,846 | 159,789 |
| 1930 | 618,341 | 611,045 | 2,938,525 | 4.81 | 51,872 | 116,308 |
| Wyoming (Western rock): | | | | | | |
| 1931 | 1,000 | 1,000 | 4,500 | 4.50 | ..... | ..... |
| 1930 | 1,339 | 1,339 | 6,000 | 4.48 | 89 | 446 |
| Grand total, 1931 | 2,577,535 | 2,534,959 | $9,288,485 | $3.66 | 223,730 | 719,238 |
| 1930 | 3,951,353 | 3,926,392 | 13,996,830 | 3.56 | 240,526 | 728,219 |

*Figures include a small quantity of hard rock tailings. †Figures included with stocks of dry hard rock.

*Wyoming*—The total output from Wyoming in 1931 was produced by one operator, the Cokeville Phosphate Co., Cokeville.

### *Imports and Exports**

Total imports of phosphate rock, crude, for consumption (also general imports) into the United States in 1931, amounting to 13,496 long tons, valued at $162,517, showed decreases of 58.7% in quantity and 56.9% in value, as compared with 1930. The total quantity imported into the United States in 1931 came from two countries only—French Oceania supplied 12,985 tons, valued at $161,219, and Soviet Russia in Europe supplied 511 long tons, valued at $1298. Imports from French Morocco have been declining since 1928 and none came from this source in 1931.

Total shipments of high-grade, land pebble and other phosphate rock, ground or unground, exported from the United States in 1931 (951,305 long tons, valued at $4,277,070) showed decreases of 22.4% in quantity and 24% in value as compared with 1930.

### *Domestic Consumption*

The apparent consumption of phosphate rock in the United States, in long tons, in 1930 and 1931 were as follows:

| Year | Marketed production | Imports | Exports | Total apparent calculated consumption† |
|---|---|---|---|---|
| 1931 | 2,534,959 | 13,496 | 951,305 | 1,597,150 |
| 1930 | 3,926,392 | 32,658 | 1,225,722 | 2,733,328 |

*Data on imports and exports compiled from records of the Bureau of Foreign and Domestic Commerce, by J. A. Dorsey of the Bureau of Mines.

†Marketed production plus imports minus exports.

## Ohio Crushed Stone Association Sponsors Meeting

MORE than 60 road contractors, highway engineers, surveyors, road material experts and chemists attended the district meeting of the Ohio Crushed Stone Association, held at the Snow Hill Country Club, near Wilmington, Ohio, June 30.

Opening with an excellent chicken dinner, the program included a series of short, interesting and educational talks, talking pictures, refreshments and golf.

Harry Brandon, of the C. C. Beam Quarries, Inc., presided at the meeting. On the program were Dr. William B. Guitteau of Toledo, editor of *Better Highways;* Fred Swineford, chief engineer of the Ohio Crushed Stone Association; Thurman Miller, Wilmington newspaper man; Bernard E. Gray, highway engineer of the Asphalt Institute, New York; Ed. Rhodes, technical director of the Koppers Products Co.; T. O. Van Camp, Columbus contractor, and Elmer Hilty, chief engineer of construction in the State Highway Department.

Dr. Guitteau emphasized highway economies, urging contractors, engineers and material experts to do all in their power to constantly improve the qualities of new highways, at the same time reducing costs.

"Throw away something good for something better," was America's prosperity days slogan, Dr. Guitteau suggested, declaring the day has come when we must utilize to the fullest extent anything good in order to afford something better.

The magazine editor urged contractors to constantly study the ways and means by which they could use the old road to more advantage as an economical foundation for the new.

The necessity of keeping the gasoline tax for the construction and improvement of roads, for which purpose it was originally levied, was pointed out.

Fred Swineford spoke on safer highway surfaces. Bernard Gray spoke about the use of road asphalt.

Mr. Rhodes read a paper on "Road Tars and Their Application." "Old Roads Made New" was the subject of Mr. Van Camp.

A round-table discussion of various engineering, construction and material problems was conducted under the leadership of Elmer Hilty.

Statistics were presented showing the greater dollar value in asphalt and bituminous roads than any other and the latest improved methods of building this type road were discussed.

Harry Brandon told of the methods the C. C. Beam Quarries use in cleaning their materials. He said 1200 gallons of clean water are used at the Beam plant to wash and thoroughly clean each ton of stone.—*Wilmington* (Ohio) *Journal.*

## Oklahoma Contractors Buy Cement Cheaper Than State

THE new policy lately established by the State Highway Commission of Oklahoma of having contractors furnish the cement for their highway construction jobs instead of furnishing it to them has resulted in tremendous savings to the state, according to J. F. McKeel, member of the commission. The commission for the past three years has purchased the cement to be used on its highways in 1,000,000 bbl. lots, but with the beginning of the construction year in 1932 the commission announced that it would abandon this policy.

Mr. McKeel states that when the commission bought the cement the bulk of the purchase came from without the state where the average haul was perhaps between 300 and 400 miles. This year contracts are let on the basis of materials being furnished by the contractor and the commission is getting unprecedented prices on the work, Mr. McKeel says. As much as $6000 per mile has been saved by the commission on concrete slab and the only cause to which this saving can be attributed is the fact that the contractors procure their materials where they can get them most conveniently and quickly, Mr. McKeel believes. When the cement had to be brought for a great distance the interruptions of traffic frequently caused many days' delay with consequent increased expense.

This expression of the experience of the department is in decided contrast to the opinion stated by A. R. Losh, former chief engineer of the commission, in an address before the convention of the American Road Builders' Association in 1931. Mr. Losh stated: "No contractor is in position to compete with the state in buying power. State furnished steel, cement, asphalt, aggregates and lumber, when purchased in large quantities, save considerable in the total cost of construction."—*The Constructor.*

## Oyster Companies Protest Dredging Operation

THE Westport, Conn., selectmen, the Longshore Beach and Country club, and two Norwalk oyster companies have filed protests with the War department against the dredging of the mouth of the Westport harbor by the Federal Sand and Gravel Co., of New York for commercial purposes.

The Talmadge Bros. Co., and the Loundes Oyster Co., both of Norwalk, have pointed out to the War department that they will face losses in oyster crop if the permit is granted.

In his protest to the War department First Selectman Mansfield says that the dredging of the harbor would injure Compo Beach as well as Great Marsh and the local harbor.—*Bridgeport* (Conn.) *Star.*

## Fights Specification on Gravel Supply for Road Work

A DEMAND that the Indiana state highway commission be enjoined from including in road specifications a proposal that gravel and sand used in the construction work must come only from gravel plant established before the date of receiving bids was made in a suit brought against the commission by the Brown-Rosenbarger Gravel Co. The petition, filed in circuit court, asked that the injunction be granted before the letting of road contracts late in May. The specification was written after large gravel companies had complained to commission members that they were unable to compete with small concerns that set up pits near roads after contracts had been let. —*Indianapolis* (Ind.) *Star.*

## Building Sand Plant in Illinois

THE Aetna Sand and Gravel Co. of Chicago, Ill., is building a sand plant half a mile west of Ottawa. Construction of the plant, which was started in the middle of June, is going on under the direction of C. Humphrey, a member of the company.

Production is to start as soon as the plant is completed.—*Ottawa* (Ill.) *Times.*

## Iowa Law Taxing Motor Truck Common Carriers Upheld by Court

ANOTHER Federal Court decision of interest to all who are concerned with the future of highway building was recently handed down by the Federal District Court, Southern District of Iowa. An unincorporated trucking contractor doing an interstate business as a common carrier refused to be governed by the Iowa laws covering taxation and regulation of motor-truck common carriers. His appeal to the Federal Court on the basis that his constitutional rights were being infringed met with defeat, the court upholding the State of Iowa. The decision reads in part:

Complainant in his oral and written argument places special emphasis on his claim that the tax is an undue and unreasonable burden on interstate commerce and is unscientific, arbitrary and unreasonable, as not being based on any use of the highway but on the earning capacity of motor vehicles and does not constitute a sufficient relation between the measure employed and the extent or manner of the use of the highway to justify a holding that the tax is a charge made merely as a compensation for the use of the highways for interstate traffic. The provisions of the act thus assailed are:

"5105-a41. * * * there shall be assessed against and collected from every motor carrier the following tax for the maintenance and repair of the highways:

"For motor vehicles having pneumatic tires, one-fourth cent per ton mile of travel." (It was conceded on the trial that all of the trucks of the complainant are equipped with pneumatic tires.)

"5105-a42. The ton-miles of freight travel shall be computed as follows: The maximum capacity of each motor vehicle, including trailers, shall be added to the weight of the vehicle; this sum shall be multiplied by the number of miles the vehicle is operated, and the amount thus obtained divided by two thousand."

* * * * *

It is well settled that the State may constitutionally impose a tax burden on interstate commerce as compensation for the use of such highways, provided the charge is only a reasonable and fair contribution to the expense of construction and maintenance of such highways and of regulating the traffic thereon. Prouty v. Coyne, 55 Fed. (2d) 289, 292, and cases there collected.

The act discussed in the case of Prouty v. Coyne was declared unconstitutional because the amount of the tax was based solely on the weight of the chassis regardless of the mileage traveled. Here the amount of the tax is based on the maximum capacity of the motor vehicle, its weight and the number of miles the vehicle is operated.

We are unable to agree with complainant that this method of computation of the tax is not predicated upon the use made or to be made of the highways of the State, which is all that is required. Interstate Transit, Inc., v. Lindsey, 283 U. S. 183. It may be as suggested by complainant that theoretically a tax based upon the amount of tonnage of the load and the distance hauled would be a better theory, but we must keep in mind that the State is entitled to charge and public policy demands that in levying and collecting the taxes due regard must be had for its proper administration.

The Supreme Court in the Continental Baking Company case, supra, discusses the provisions of the Kansas Motor Vehicle Act which are similar as to the method of computation of the tax, and says:

"It is not shown that either regulations or license fees are unreasonable."

And later in the same case, states:

"This court has frequently held that the mere selection of a mileage basis in the regulation of railroads cannot be considered a violation of the Federal Constitution. The practical convenience of such a classification is not to be disregarded in the interest of a purely theoretical or scientific uniformity."

* * * * *

The other major contention of complainant is as to the requirement of the statute that public motor carriers of freight must furnish a bond to protect shippers. It may be conceded that the imposition of a requirement to furnish an indemnity bond as a condition precedent to a right to carry goods in interstate commerce would be an unreasonable burden upon a private carrier, (Michigan Commission v. Duke, supra), however, a different situation and rules govern a public or common carrier.

And the recent case of Continental Baking Co. v. Woodring, supra, holds such a provision not constitutionally objectionable as against the public or common carrier where no discrimination is made against the interstate carrier. In that case the Supreme Court said:

"Requirements of this sort are clearly within the authority of the State which may demand compensation for the special facilities it has provided and regulate the use of its highways to promote the public safety. Reasonable regulations to that end are valid as to intrastate traffic, and, where there is no discrimination against the interstate commerce which may be affected, do not impose an unconstitutional burden upon that commerce. Motor vehicles may properly be treated as a special class, because their movement over the highways, as this court has said, 'is attended by constant and serious dangers to the public, and is also abnormally destructive to the ways themselves.'"

## Trucking Company Proposes to Operate Quarry with City Help

BIDS on crushed stone, gravel and sand for use by the city of Oshkosh, Wis., during the current year were opened by the board of public works, on June 21, and referred to the engineering department for tabulation, without discussion.

An unusual offer was made by the C. M. Genal Trucking Co. which submitted regular bids on gravel and sand, but made a special offer in connection with crushed stone.

Stating it was known such an offer was not in accord with the request for bids, but asking that the city consider it, the concern proposed to supply crushed stone at 97½ c. at the quarry, $1.47½ anywhere on the south side, and $1.70 anywhere on the north side, if the city would enter into a special arrangement.

It was suggested that the Genal concern supply six regular men and that the city supply 24 men on a five-hour day basis, to work at the quarry, and to be paid by the Genal company at the rate of 30c. an hour. These men could be rotated by the city as the city would see fit.

The concern also would agree to use hand labor as far as practicable, and would ask the city to guarantee purchase of 3,000 yd. of material during the season.

The Cook and Brown Lime Co. made a bid of $2.25 a yd. for crushed stone, and the Lutz Co. submitted the same bid. On gravel, the Genal bid was $1.13 and 98c., while the Cook and Brown Lime Co. bid was $2.25.

The low bid on sand was submitted by Otto Schoenian, 92½c. a yd. The Genal bid was 98c., that of the Cook and Brown Co., $2, and the Lutz Co., $2.—*Oshkosh* (Wis.) *Northwestern.*

## New York Producers Active in Saving Highway Funds for Highways

THE New York State Construction Council which, earlier in the year was actively engaged in a campaign to urge the Governor to call a special session of the Legislature for the purpose of appropriating additional highway funds, has now been made a permanent organization and Thomas E. Wright has been engaged as executive secretary, with headquarters at 515 Taylor Building, Rochester, N. Y.

While the object of the earlier campaign was to urge the special session of the Legislature, this was simply a mark to shoot at and something to engage the interests and enthusiasm of all the workers and was by no means the ultimate object.

The necessity has become increasingly apparent, during the past couple of years, for some organization which would include in its membership all parties and firms interested, either directly or indirectly, in public works construction. The action of the Legislature, during its last regular session, in diverting gasoline and motor vehicle tax funds to purposes other than these funds were intended, indicates the great necessity of such an organization and the desirability of perfecting it at the earliest possible date.

The foregoing paragraphs are from an official announcement by Harold V. Owens, chairman of the New York State Construction Council. Mr. Owens, as most readers probably know, is president of the Eastern Rock Products, Inc., Utica, N. Y., sand, gravel and crushed stone producer. Mr. Owens is also president of the National Sand and Gravel Association. On the executive committee of the Council is also W. L. Sporborg, of the General Crushed Stone Co., Syracuse, N. Y., a director of the National Crushed Stone Association. The board of directors of the Council also includes the names of such well-known rock products producers as H. N. Snyder, Buffalo Slag Co., Federal Crushed Stone Co., Buffalo; E. L. Heidenreich, Jr., New York Trap Rock Co., Newburgh; J. L. Heimlich, LeRoy Lime and Stone Co., LeRoy (president of the New York State Crushed Stone Association); J. E. Cushing, Cushing Stone Co., Schenectady.

## Sand-Lime Brick Production and Shipments in June

THE FOLLOWING DATA are compiled from reports received direct from producers of sand-lime brick, located in various parts of the United States and Canada. The accompanying statistics may be regarded as representative of the industry.

Fourteen sand-lime brick plants reported for the month of June, this number being three less than the number reporting for the month of May, statistics for which were published in our issue of June 18.

Figures for the month of June indicate that production remains about the same as in the previous month. A slight decrease is shown in rail and truck shipments. Stocks on hand decreased, and an increase is shown in unfilled orders.

***Average Prices for June***

| Shipping point | Plant price | Delivered |
|---|---|---|
| Detroit, Mich. | ..... | $12.50 |
| Grand Rapids, Mich. | $10.00 | ..... |
| Milwaukee, Wis. | 8.50 | 10.50 |
| Mishawaka, Ind. | 8.00 | ..... |
| Saginaw, Mich. | 10.00 | ..... |
| Syracuse, N. Y. | 18.00 | 20.00 |
| Toronto, Ont., Can. | 11.40 | 13.50 |

***Statistics for May and June***

| | †May | *June |
|---|---|---|
| Production | 2,469,000 | 2,170,446 |
| Shipments (rail) | 157,000 | 121,000 |
| Shipments (truck) | 2,918,990 | 2,425,423 |
| Stocks on hand | 4,897,032 | 3,384,764 |
| Unfilled orders | 2,575,000 | 6,625,000 |

†Seventeen plants reporting; incomplete, one not reporting production, and seven not reporting unfilled orders. *Fourteen plants reporting; incomplete, one not reporting production, one not reporting stocks on hand and seven not reporting unfilled orders.

## Recent Prices Bid and Contracts Awarded

*Bloomington, Ind.* Contract to supply 1000 cu. yd. of crushed stone was divided equally between the Bloomington Crushed Stone Co. and the Monroe County Crushed Stone Co. Both companies bid 96c. per ton. Other contracts awarded for repair stone containing more fines ranged from 81c. to 99c. per cu. yd. Prices were approximately 13% under last year, it is stated.

*Fallon, Nev.* The Nevada Contracting Co. has been awarded contract for 1000 cu. yd. of gravel in place with an average haul of about 1½ mi. from Fallon at $1.92 per cu. yd.

*Hamilton, Ohio.* The Hamilton Gravel Co. was low bidder on 350 cu. yd. of gravel to be delivered on the Beagle road at 87c. per cu. yd. A. B. Magaw was low bidder on 550 cu. yd. of gravel for the Stahlhaber road at 84½c. per yd.

*De Pere, Wis.* Contracts for furnishing crushed stone or gravel for eight towns in this county have been awarded as follows: Humboldt, Peter Rentmeester, gravel, 85c. per cu. yd.; Scott, William Beaumier, and Clarence Dappern, stone in the bin, 65c. per cu. yd.; Preble, William Sheedy, gravel, 82c. per cu. yd.; Holland and Wrightstown, M. J. Lotto Construction Co., gravel, 94c. and $1.27 per cu. yd. respectively; and Hobart, Danen and Janssen, stone, $1.46 per cu. yd.

*Mt. Gilead, Ohio.* A. M. Hamilton and Son of Marion were awarded contract for crushed stone here recently. They bid $1.35 per cu. yd. delivered on the streets for 500 yd. The contract was awarded to this company because of better quality stone and nearness to the village, councilmen said.

## Oil Refinery Waste for Cement Admixtures

J. M. EVANS, oil expert in San Francisco, Calif., is reported to be interested in promoting the use of a byproduct of the petroleum refining industry as an admixture for portland cement.

The material is clay used to filter oil, which when ground up and mixed with portland cement is said to improve plasticity and render mortar and concrete waterproof.

## County Quarried Stone Costs $1.15 per Cu. Yd.

APPROXIMATELY 9500 cu. yd. of sandstone, to be used on roads of Ohio county, West Virginia, has been quarried at the Carney estate, near Wheeling, by the county.

The quarried stone, counting labor, materials and quarry rights, cost the county $10,925, or $1.15 per cu. yd., the *Wheeling News* reports. The local stone was used in place of slag.

## Claims to Have Originated Central Mixed Concrete

CLAIMING that he had an oral contract for one-third ownership and one-third profits of the Pioneer Sand and Gravel Co., John A. Peabody made claim for $394,000 in the superior court at Seattle, Wash., on June 27.

According to his story, in 1924 he went to the late H. F. Ostrander, president of the company, and told him of a secret process he had invented to mix cement at a central mixing plant and transport it by fast motor trucks to the scene of operation.—*Seattle* (Wash.) *Post-Intelligencer.*

## Concrete Paving Yardage

CONCRETE PAVEMENT yardage as awarded in the United States during June and for the period ending July 2 as reported by the Portland Cement Association follow:

| | Yardage awarded | |
|---|---|---|
| | During June, 1932 | To date, July 2, 1932 |
| Roads | 10,038,405 | 40,439,971 |
| Streets | 948,412 | 3,662,123 |
| Alleys | 81,389 | 197,873 |
| Totals | 11,068,206 | 44,299,967 |

RETAIL MATERIAL PRICES, DELIVERED, JUNE 1, 1932 (COMPILED BY DEPARTMENT OF COMMERCE)

| City | Portland cement, per bbl. exclu. of cont. | Gypsum wallboard, ⅜-in., per M | Hydrated lime, per ton | Building sand, per cu. yd. | Crushed stone, ¾-in., per ton | Gypsum plaster, neat, per ton |
|---|---|---|---|---|---|---|
| New Haven, Conn. | $2.40 | ..... | $25.00 | $1.25 | $2.00 | ..... |
| New London, Conn. | 2.20 | $25.00 | 18.00 | 1.50 | 3.00 | $18.00 |
| Waterbury, Conn. | 2.60 | 30.00 | 18.00 | 1.00 | 2.45 | 18.00 |
| Haverhill, Mass. | 2.40 | 25.00 | 16.00 | ..... | ..... | 19.00 |
| New Bedford, Mass. | 2.40 | 25.00 | 16.00 | 1.25 | 2.50 | 16.00 |
| Albany, N. Y. | 2.34 | 23.85 | 15.75 | ..... | ..... | 16.20 |
| Buffalo, N. Y. | 2.95 | 21.00 | 18.00 | 2.50 | 2.05 | 16.00 |
| Poughkeepsie, N. Y. | 2.00 | ..... | 18.00 | 1.25 | 2.20 | ..... |
| Rochester, N. Y. | 2.28 | 22.00 | 14.58 | 2.00 | 2.40 | 16.00 |
| Paterson, N. J. | 2.00 | 24.00 | 18.00 | 1.50 | 2.10 | 17.50 |
| Trenton, N. J. | 2.10 | 29.00 | 13.50 | 1.60 | 1.50 | 14.75 |
| Philadelphia, Penn. | 2.00 | ..... | 13.75 | 1.75 | 2.60 | 16.50 |
| Scranton, Penn. | 2.40 | 30.00 | 18.00 | 4.39 | ..... | 18.00 |
| Baltimore, Md. | 2.10 | 25.00 | 13.00 | 1.85 | 2.50 | 15.50 |
| Washington, D. C. | 1.65 | 22.50 | 12.00 | ..... | ..... | 14.00 |
| Richmond, Va. | 2.80 | 38.00 | 20.00 | 2.23 | ..... | 18.00 |
| Fairmont, W. Va. | 2.50 | 35.00 | 16.00 | 2.60 | 3.25 | 18.00 |
| Columbia, Tenn. | 2.32 | 22.00 | 12.00 | 1.00 | 2.75 | 16.60 |
| Atlanta, Ga. | 2.55 | 36.00 | 15.50 | 2.81 | 2.75 | 20.15 |
| Tampa, Fla. | 2.40 | 50.00 | 24.00 | 2.00 | 2.80 | ..... |
| New Orleans, La. | 2.35 | 37.20 | 14.00 | 1.85 | ..... | 18.00 |
| Akron, Ohio | 1.81 | ..... | 14.00 | 1.50 | 1.55 | 15.50 |
| Cincinnati, Ohio | 2.40 | $25.00 | $14.00 | $2.36 | $2.00 | ..... |
| Cleveland, Ohio | 2.00 | ..... | 12.00 | 1.82 | 2.25 | 18.00 |
| Columbus, Ohio | 2.00 | ..... | 14.00 | 1.22 | ..... | 16.00 |
| Toledo, Ohio | 1.40 | 20.00 | 12.00 | 1.40 | 1.60 | 14.00 |
| Lansing, Mich. | 2.15 | ..... | 18.00 | 2.10 | ..... | 16.00 |
| Saginaw, Mich. | 1.90 | 20.00 | 16.00 | 2.50 | 2.20 | 17.50 |
| Terre Haute, Ind. | 2.00 | 28.00 | 18.00 | 1.25 | 3.00 | 18.00 |
| Louisville, Ky. | 1.86 | ..... | 15.00 | 2.00 | 2.15 | 17.00 |
| Milwaukee, Wis. | 1.32 | 22.00 | 18.00 | 1.35 | 1.35 | 15.20 |
| Des Moines, Iowa | 1.82 | 23.50 | 18.00 | 1.40 | ..... | 14.00 |
| Kansas City, Mo. | 1.90 | 25.00 | 22.00 | 2.46 | 1.88 | 17.00 |
| St. Paul, Minn. | 2.10 | 23.00 | 19.00 | 1.25 | 1.75 | 17.00 |
| Grand Forks, N. D. | 2.60 | ..... | 28.00 | 2.60 | ..... | 19.00 |
| Sioux Falls, S. D. | 2.00 | 38.00 | 20.00 | 1.25 | 1.75 | 16.00 |
| Wichita, Kans. | 2.07 | 25.00 | 22.50 | 1.00 | ..... | 15.50 |
| Tulsa, Okla. | 1.80 | 30.00 | 22.00 | .85 | 1.50 | 16.00 |
| San Antonio, Tex. | 2.41 | 39.00 | 20.00 | 2.00 | 2.00 | 18.15 |
| Tucson, Ariz. | 3.24 | 45.00 | 29.80 | 1.25 | 2.25 | 17.10 |
| Los Angeles, Calif. | 2.30 | 23.50 | 24.70 | 1.25 | 1.40 | 15.20 |
| San Francisco, Calif. | ..... | 45.00 | 22.50 | 1.40 | 1.60 | 17.30 |
| Seattle, Wash. | 2.70 | ..... | ..... | ..... | ..... | ..... |

# Pennsylvania-Dixie Mill Celebrates

## Plant at Valley Junction, Iowa, Dedicates Safety Trophy

MILL No. 8 of the Pennsylvania-Dixie Cement Corp., located at Valley Junction, Iowa, dedicated its new Portland Cement Association safety trophy with fitting exercises on Thursday morning, July 7. The occasion was undoubtedly the most interesting that has ever taken place at the plant and was an outstanding event in the industrial life of the community, which adjoins Des Moines.

Present for the occasion as special guests were Blaine S. Smith of New York, president of Penn.-Dixie and a director of the Portland Cement Association; Hon. G. C. Greenwalt, Secretary of State of Iowa; W. H. Klein, Chattanooga, Tenn., general manager of Penn.-Dixie; Stanley Owens, safety engineer of the Portland Cement Association, Chicago, and Mayor P. L. Riley of Valley Junction. Four hundred local guests, including industrial leaders of the Des Moines area, employes of the plant and their families and friends, were also present.

The ceremonies were held in a plat before the plant, created as a suitable spot for the erection of the trophy. A large speaker's stand and suitable seating were provided. R. A. Bechtold, superintendent of the plant, under whose leadership the accident-less year of operation was achieved in 1931, called the meeting to order and directed the ceremonies. The formal program was as follows:

Flag Raising — Valley Junction Post, American Legion.

Invocation—Rev. Sherman B. Moore.

Music — Valley Junction High School Band.

Opening Remarks—W. H. Klein, general manager.

Address of Welcome—Mayor P. L. Riley of Valley Junction.

Presentation of the Trophy — Stanley Owens, safety engineer, Portland Cement Association.

Unveiling of Trophy—Misses Dorothy Wolfe, Beatrice Woolley, Belva Bishop, Edith Goodrich.

Acceptance of Trophy—Harley Matherley, raw mill operator.

Music by band.

Address—Blaine S. Smith, president.

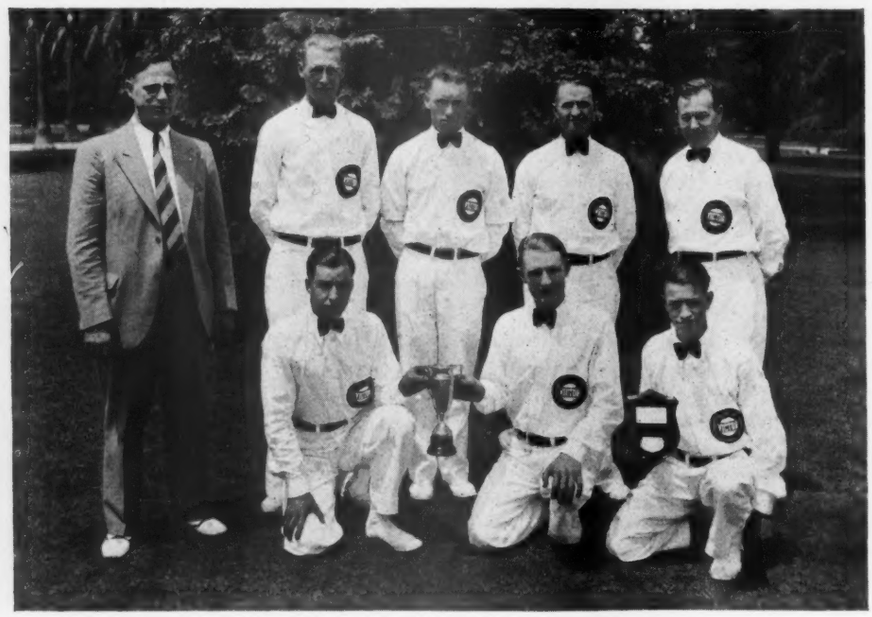
Address—Hon. G. C. Greenwalt, Secretary of State.

Music by band.

Benediction—Rev. Matthre Gleeson.

President Blaine S. Smith, known throughout industrial circles as a safety booster, paid compliment to the fine work of his Valley Junction employes and emphasized that his personal interest in their progress was the factor that had taken him away from his work in New York in order to spend the day in Des Moines. Secretary of State Greenwalt deplored the accident toll to workers in the industry and praised the Portland Cement Association and its member mills for their outstanding work in accident prevention.

At the conclusion of the ceremonies the handsome monument was inspected by the crowd, after which a buffet luncheon was served to mill employes, their families and guests.



***First-aid team of Southwestern Portland Cement Co., Victorville, Calif.***

The general safety committee of the Valley Junction plant, which was responsible for the successful safety campaign of 1931, was as follows: R. A. Bechtold, superintendent; E. N. Dodd, safety engineer; C. W. Ellis, purchasing agent; M. L. Silcox, chief chemist; J. R. Guidi, master mechanic; J. H. Henderson, shift foreman; S. H. Griffith, shift foreman; Lee Eslinger, quarry foreman; Cloyd Thornsberry, chief electrician; H. E. Thompson, shop foreman; T. A. Miller, yard foreman; Henry Kline, crusher foreman; O. E. Roe, superintendent, Modern Valve Bag Co., and A. E. Sherwood, pack house foreman.

### *Victorville Team Wins Second Place in Southern California*

The accompanying illustration shows the first-aid team of the Southwestern Portland Cement Co., Victorville, Calif., which won second place in the American Red Cross Southern California competition of first-aid teams, which was held at Lincoln high school, Los Angeles, June 18. This team has been advancing steadily and is openly out after the Southern California and California state championships next year.

Those in the picture are as follows: At the left, not in uniform, Harry Sergeant, safety director and first-aid instructor at the Victorville plant. Lower row, T. Silvestri, C. Nielson and J. Martin. Upper row, F. Burnett, George Stinebaugh, J. Burr and P. Anthony.

### *Ormrod Plants Active for Safety*

The illustration following shows the safety committees of the Lehigh Portland Cement Co.'s two mills at Ormrod, Penn., the pioneer operating units of the Lehigh company. This picture was taken on the occasion of the recent joint meeting of these committees. Plant No. 2 completed 1929, 1930 and 1931 without a lost-time accident. On July 25, 1932, it will celebrate four continuous years of accident-free performance. Plant No. 3 was to celebrate two continuous accident-free years on July 15.

## Winners of Safety Competition in 1931

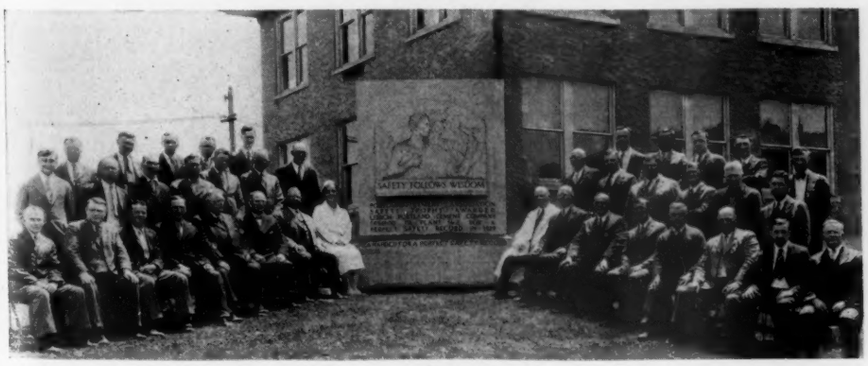
ANNOUNCEMENT has been made of the winners of the National Safety Competition of 1931 by Scott Turner, Director of the Bureau of Mines. Approximately 350 mines and quarries in 34 states participated in the competition, and 68 large operations had no lost-time accidents.

In the nonmetallic mineral group first place was given to the Retsof rock salt mine at Retsof, N. Y., operated by the Retsof

Mining Co., which had no lost-time accidents during a period of 354,722 man-hours. Fifty-six quarries in the rock products industry received honorable mention, all of which operated throughout the year without a lost-time accident.

HONORABLE MENTION

Universal Gypsum and Lime Co., Akron Gypsum Mine, Akron, N. Y.
Missouri Portland Cement Co., Independence Limestone Mine, Independence, Mo.
United States Gypsum Co., No. 6 Gypsum Mine, Plasterco, Va.
American Lime and Stone Co., Bell Limestone Mine, Bellefonte, Penn.
Lehigh Portland Cement Co., Ormrod Cement Rock Quarry, Ormrod, Penn.
Pittsburgh Plate Glass Co., Columbia Limestone Quarry, Zanesville, Ohio.
Lehigh Portland Cement Co., Fogelsville Limestone Quarry, Fogelsville, Penn.
Glens Falls Portland Cement Co., Glens Falls Limestone Quarry, Glens Falls, N. Y.
Bethlehem Mines Corp., Hanover Limestone Quarry, Hanover, Penn.
North American Cement Corp., Martinsburg Nos. 5 and 6 Limestone Quarry, Martinsburg, W. Va.
The General Crushed Stone Co., Rock Hill Traprock Quarry, Quakertown, Penn.
Lehigh Portland Cement Co., Mason City Limestone and Clay Quarry, Mason City, Ia.
Union Limestone Co., Hillsville Limestone Quarry, Hillsville, Penn.
Lehigh Portland Cement Co., Sandt's Eddy Cement Rock Quarry, Sandt's Eddy, Penn.
Natural Rock Asphalt Corp., Natural Rock Asphalt Quarry, Natural Rock, Ky.
The John T. Dyer Quarry Co., Birdsboro Quarry, Birdsboro, Penn.
The General Crushed Stone Co., Akron Limestone Quarry, Akron, N. Y.
Alpha Portland Cement Co., Catskill Limestone Quarry, Alsen, N. Y.
Lone Star Cement Co., Pennsylvania; Nazareth Cement Rock Quarry, Nazareth, Penn.
The General Crushed Stone Co., Rock-Cut Limestone Quarry, Syracuse, N. Y.
Lehigh Portland Cement Co., Union Bridge Limestone Quarry, Union Bridge, Md.
North American Cement Co., Security Limestone Quarry, Security, Md.
The Cleveland Quarries Co., No. 7 Sandstone Quarry, Amherst, Ohio.
The Connecticut Quarries Co., Inc., Middlefield Traprock Quarry, Wallingford, Conn.
Bethlehem Mines Corp., Naginey Limestone Quarry, Naginey, Penn.
Southwest Stone Co., Knippa No. 4 Traprock Quarry, Knippa, Tex.
Cowell Portland Cement Co., Cowell Limestone Quarry, Cowell, Calif.
Lawrence Portland Cement Co., Thomaston Cement Quarry, Thomaston, Me.
Wickwire Spencer Steel Co., Gasport Dolomite Quarry, Gasport, N. Y.
Zenith Limestone Co., Tulsa Quarry, Tulsa, Okla.
American Lime and Stone Co., Union Furnace Limestone Quarry, Tyrone, Penn.
Bethlehem Mines Corp., Steelton Limestone Quarry, Steelton, Penn.
Lehigh Portland Cement Co., Birmingham Limestone Quarry, Tarrant City, Ala.
Lehigh Portland Cement Co., Iola Limestone Quarry, Iola, Kan.
Louisville Cement Corp., Speed Mill Quarry, Speed, Ind.
Lehigh Portland Cement Co., Mitchell (Lehigh Lime Co.) Limestone Quarry, Mitchell, Ind.
Alpha Portland Cement Co., Martins Creek No. 4 Cement Rock Quarry, Martins Creek, Penn.
Dewey Portland Cement Co., Dewey Limestone Quarry, Dewey, Okla.
Santa Cruz Portland Cement Co., San Vicente Limestone Quarry, Davenport, Calif.
Lehigh Portland Cement Co., Oglesby Limestone Quarry, Oglesby, Ill.
Lawrence Portland Cement Co., Thomaston Limestone Quarry, Thomaston, Me.
Nazareth Cement Co., Nazareth Limestone Quarry, Nazareth, Penn.
Pennsylvania-Dixie Cement Corp., Marcem Limestone Quarry, Gate City, Va.
Yosemite Portland Cement Corp., Clearinghouse Limestone Quarry, Clearinghouse, Calif.
Lone Star Cement Co., Texas; Dallas Limestone and Shale Quarry, Dallas, Tex.
The General Crushed Stone Co., Hendlers Quartzite Quarry, Wilkes-Barre, Penn.
Petoskey Portland Cement Co., Petoskey Limestone Quarry, Petoskey, Mich.
Florida Portland Cement Co., Brooksville Lime Rock and Clay Quarries, Brooksville, Fla.
Superior Portland Cement, Inc., Concrete Limestone Quarry, Concrete, Wash.
Duluth Crushed Stone Co., Duluth Traprock Quarry, Duluth, Minn.
Southwestern Portland Cement Co., El Paso Limestone Quarry, El Paso, Tex.
Hercules Cement Corp., Stockertown Cement Rock Quarry, Stockertown, Penn.
United States Gypsum Co., Fort Dodge Gypsum Quarry, Fort Dodge, Ia.
Pennsylvania-Dixie Cement Corp., Plant No. 4 Limestone and Cement Rock Quarry, Nazareth, Penn.
Trinity Portland Cement Co., Dallas Limestone Quarry, Dallas, Tex.
Lawrence Portland Cement Co., Bonneville Cement Rock Quarry, Northampton, Penn.
The Connecticut Quarries Co., Inc., Rocky Hill Traprock Quarry, Rocky Hill, Conn.
Medusa Portland Cement Co., Dixon Limestone Quarry, Dixon, Ill.
Calaveras Cement Co., San Andreas Limestone Quarry, San Andreas, Calif.



***Safety committee of Ormrod, Penn., mills of the Lehigh Portland Cement Co.***

## Pennsylvania Plans Greater Rock Products Industry

TWO INVESTIGATIONS of particular interest to the stone and construction industries and to the architectural and engineering professions are being conducted by experienced research workers under the Greater Pennsylvania Council, a state planning organization, whose headquarters are in Harrisburg, Penn.

One is a study of the physical and chemical characteristics of Pennsylvania building stones, to encourage the use of such stones wherever they may be found suitable.

Another is a study of Pennsylvania slate, directed particularly toward ascertaining the possibilities of impregnating slate with colors that will withstand not only abrasion, but the solvent action of water and other liquids and of surfacing slate by the deposition of metal. Both researches, of course, are directed toward opening up new market possibilities for Pennsylvania products.

The council, a state department, was created by the 1931 Pennsylvania legislature to plan the wider development of the state's resources and the welfare of its people. Its chairman is Dr. Ralph D. Hetzel, president of Pennsylvania State College; its director is Dr. Charles Reitell, formerly of the University of Pittsburgh, and the chairman of its technical advisory committee is William A. Hamor, of Mellon Institute of Industrial Research, Pittsburgh, Penn.

The use of planned foresight, based on scientific knowledge and research, is the keynote of the council's comprehensive industrial, economic, agricultural, recreational and informational program.

A bureau of technical information, which will supply upon request reliable economic, technological and scientific information regarding Pennsylvania, has been established at Mellon Institute, Pittsburgh. Free use of this service is invited.

Both the stone and slate research projects are located in the laboratories of the School of Mineral Industries at the Pennsylvania State College.

The stone project is being conducted by C. L. Perkins, an engineer, assisted by Don C. Lynn, a ceramist. Physical, chemical and weathering studies are being made; the most promising stones are being evaluated for architectural and constructional purposes. An attempt also will be made to develop laboratory methods that will foretell changes in color of stone from long-time exposure. Consideration will be given to methods of cleaning and preserving stone, and methods of developing or applying attractive colors.

The very complete data of the Pennsylvania Topographic and Geologic Survey is being used for geological information, as well as the data accumulated by geologists of various colleges and universities.

The slate project is in charge of Clyde M. Bible, formerly of Mellon Institute, who is using laboratory facilities of the School of Mineral Industries. Units of the slate industry in Pennsylvania are cooperating.

The resulting fund of specific knowledge of Pennsylvania stones and slate will be freely available to the stone and construction industries, to the architectural and engineering professions and to all others interested in building materials.

## To Exhibit Veneered Gypsum Wallboard

TO DEMONSTRATE a new process of applying wood veneers to gypsum board for interior decoration, the U. S. Gypsum Co., Chicago, Ill., in cooperation with J. H. Smith Veneers, Inc., are installing a complete walnut interior to one of the conference rooms in the Administration building of the Century of Progress Exposition. The ceiling will be treated with U. S. Gypsum stripping and Textone.

An interesting feature of the application is that the veneer concern keeps a complete and accurate record of the walnut trees from which their veneers are obtained.

Cement Products

TRADE MARK REGISTERED WITH U. S. PATENT OFFICE

# Southern Concrete Plant With Discriminating Name

## T. L. Herbert & Sons Operate "Continuous Mix" Concrete Plant at Nashville, Tenn.

By Frances Sinclair

WHEN T. L. Herbert and Sons, Nashville, Tenn., considered building a central-mixed concrete plant it was obvious that the site of their retail yard and warehouse met the most important requirements as to plant location; namely, nearness to the supply of concreting materials and good transportation. The yard is located on the bank of the Cumberland river, with ample railroad facilities and within a mile of the business center of the city. It was large enough to accommodate the new mixing plant with storage space for large quantities of material and with room for future expansion.

The plant has a capacity of 800 cu. yd. of concrete per day and is thoroughly modern in its mechanical equipment and arrangement. It is electrically operated and is designed so that one man can easily operate it.

### *Handling of Sand and Gravel*

Gravel is brought in by barge and is transferred from the barge to the jig plant by a stiffleg derrick. There it is cleaned and screened and is conveyed by tram car to a hopper. Sand is classified on the dredge, handled by the derrick in the same way and also conveyed by tram car to the hopper. The classified materials from the hopper are taken to the top of the plant by a Link-Belt conveyor where by means of a turnspout the materials may be put into any one of six compartments. Two of these compartments are for sand and four for gravel, each compartment having a capacity of 175 tons. Three sizes of coarse aggregate are kept on hand, ⅝ in. to ¼ in., 1¼ in. to ⅝ in. and 2 in. to 1¼ in.

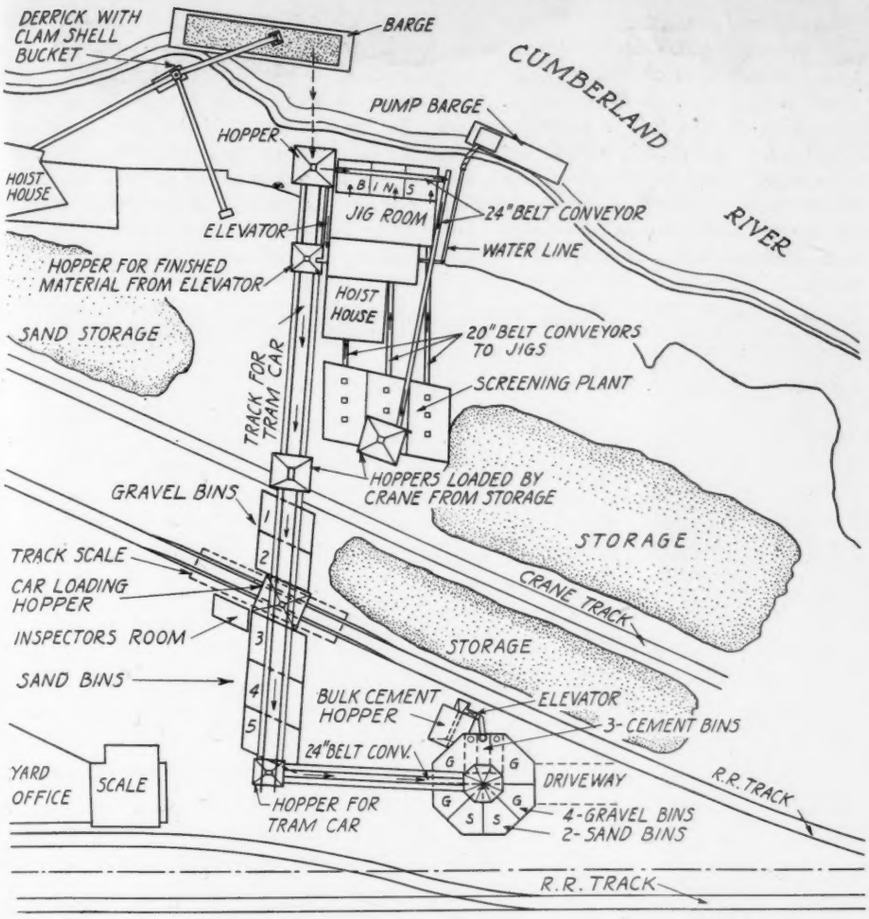
### *The Mixing Plant*

A Johnson 3-yd. weighing batcher of the cone type and with beam scales is set so as to receive materials from all of the compartments and the proportioning and mixing controls are centralized at a platform above the mixer. The operator, standing at the levers, controls the aggregate gates, and by the use of a chart weighs the exact quantities of material required for a batch of the desired proportions and strength. Sand and gravel are weighed in the same hopper but each size of gravel and the sand are weighed on separate beams.

### *Handling Cement*

The plant is designed for handling cement in bulk for several reasons, economy being the chief one. The cleaning, handling and shipping of empty sacks is eliminated, less labor is required and there is quicker unloading of cars or trucks. The price of bulk cement is less. There are no lost or dam-

*Concrete mixing plant with fleet of agitator type delivery trucks alongside*




***Plan of yards showing location of concrete mixing plant***

aged sacks and no bookkeeping for sacks. Cement is brought to the plant either by truck or rail and is dumped into a hopper and carried to the top of the plant by a Link-Belt bucket elevator. Three bins of 300 bbl. capacity are provided for three brands of cement. Valves at the bottom of these bins are operated by levers on the control platform. The Johnson weighing batcher for cement is also of the conical type, of 24 cu. ft. capacity, and has three selective filling valves with canvas spout dust guards for filling and discharging. This weighing batcher is equpped with a Toledo springless dial scale of 3000 lb. capacity, graduated to 5-lb. increments. The levers are operated from the central floor control and are adjacent to the levers of the sand and gravel bins. A change can be made immediately from one grade of cement to another by a mere shifting of valves. A small air compressor is used for aerating the cement when it tends to arch at the discharge opening and for cleaning out the bin.

### *Water Control*

The latest type of Ransome water meter is used for water measurement. Water is turned into the mixer first and the aggregate and cement are then charged into the 3-yd. Ransome mixer. A clutch arrangement controls the discharge of the concrete into the discharge chute. Adjustable telescopic chutes which can be swung out of the way when not in use convey the concrete from the discharge chute into the truck and prevent waste.

Moisture and gradation tests are run regularly so that corrections can be made for any change in the materials. All proportioning is done by the solid volume method. Test cylinders are made and broken regularly by a Barrow-Agee Testing Laboratory representative who stays at the plant.

### *Heating System for Cold Weather*

The heating plant is of the company's own design and consists of a high pressure steam system in which coils are used in all of the material compartments. These coils are electrically welded to avoid the use of threaded fittings. Each coil is fed from a main header on the outside of the bin and all of the coils carry 125 lb. steam pressure. The coils in the sand compartments are located at the bottom of the bin diaphragm shell so as to allow the sand to pass over them as it is drawn out. The coils in the gravel compartments are placed at an angle so that the greatest amount of material may be heated. All materials drawn from the gravel compartments must pass by and around the coils thus effectively heating the materials as they lie in the compartments. In the gravel compartments the coils are held in place by rods; in the sand compartments, they are secured to the compartment slope. A storage tank and pump take the condensate from the coils back into the boiler at high temperatures, thus saving fuel.

The boiler is a Cleaver-Brooks 60 hp., model E, oil-burning, down-draft type and is set next to the concrete mixer adjoining a 2000 gal. water heater, which is used for heating the mixing water in cold weather.

***The trucks allow of spouting the concrete a considerable distance***

A 1200 gal. fuel oil tank is located just below the boiler and water heater. The advantage of this type of boiler is that it is comparatively small and may be mounted where a coal-burning unit would be impracticable.

### *The "Continuous-Mix" Fleet*

Six Rex Moto-Mixers of the 3-yd. size and two of the 1½-yd. size are used for deliveries of concrete. The mixer truck is filled through a wide hatch opening in the top. En route to the job the drum is revolved, keeping the material, as the trade name implies, continuously mixed by means of the 11 buckets and four blades in the drum. The Heil "jackass" hoist used on these mixing bodies raises the rear end instead of the front end of the body, giving greater chuting distance to foundations, to the sides of the road in paving work and across curbs and fences.

### *Concrete Prices*

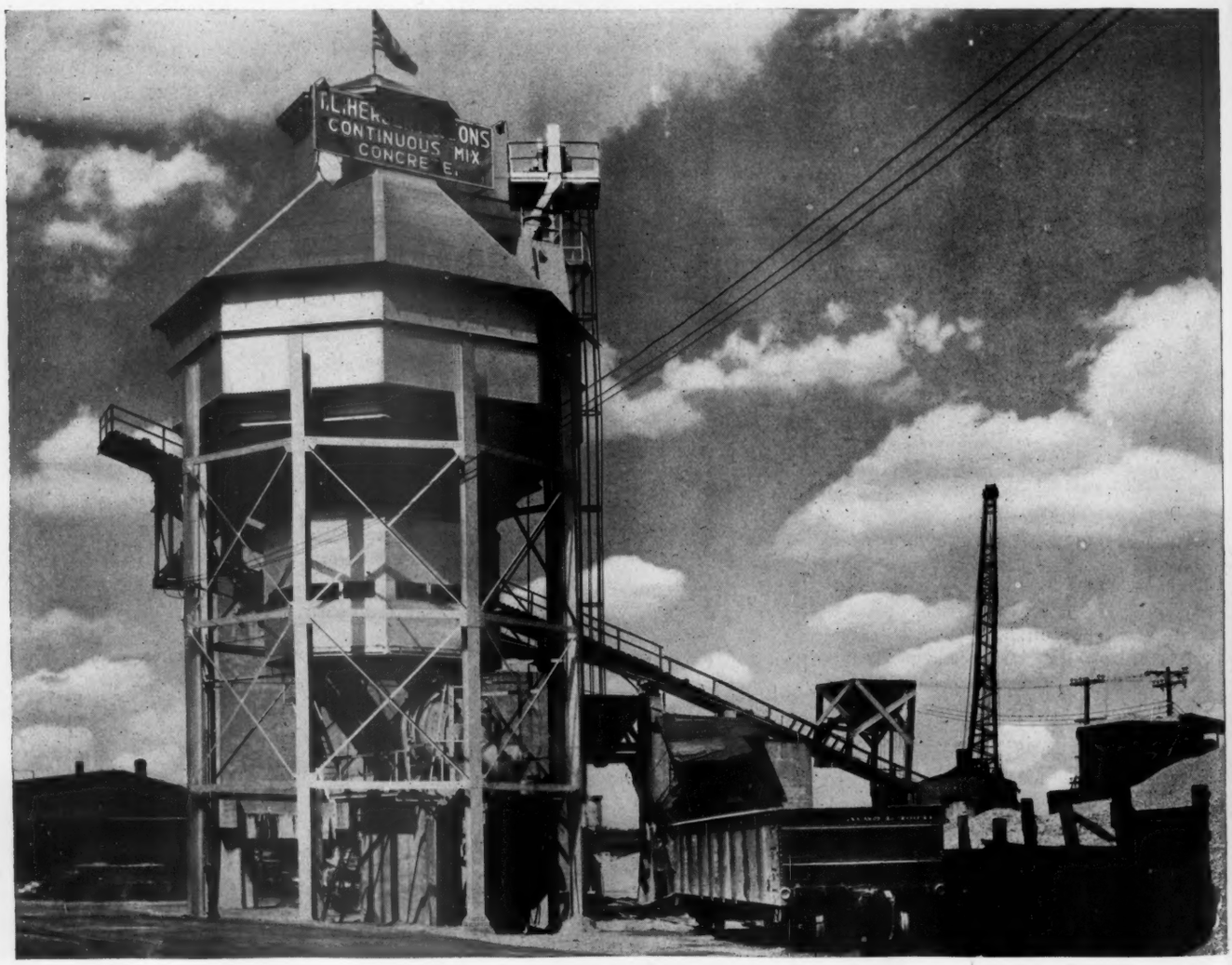
Prices on mixed concrete are based on two list prices; one is on quantities from 1 to 92 cu. yd.; the other on quantities from 93 to 500 cu. yd., in which the prices are based on carload prices of cement. Below are the prices on one mile delivery for various mixes and strengths.

A discount is allowed for larger quantities. These prices are based on concrete made with 2¼-in. or 2-in. gravel. For concrete made with 1½-in. or 1¼-in. gravel they are 10c. per cu. yd. higher. For concrete made with 1-in. or ¾-in. gravel, 20c. per cu. yd. is added to these prices. Hauling for one mile is included in these prices. For each additional half mile or fraction thereof 8c. per cu. yd. is added. A cash discount of 5c. per cu. yd. is allowed for payment on the 10th of the following month. The standard testing cost is absorbed by the seller.

Test samples are taken at the mixer or from the truck only and in accordance with the standards of the American Society for Testing Materials. If the point of delivery is not accessible, the seller reserves the right to place a hopper on the job at a convenient point for unloading. A flat charge of $2 is made for the use of the hopper. In cases where it is necessary to deliver concrete into wheelbarrows or buggies, an additional charge of 50c. per cu. yd. is made where the purchaser furnishes the barrows.

LIST PRICES PER CU. YD. ON CONCRETE AND MORTAR DELIVERED IN FIRST ZONE

| Mixes | Delivered first mile: 1 to 92 cu. yd. | Delivered first mile: 93 to 500 cu. yd. | Expected compressive strength, lb. per sq. in. with various slumps: 3 to 4 in. | 6 to 7 in. |
|---|---|---|---|---|
| 1-2-0 | $13.08 | $10.67 | ..... | ..... |
| 1-3-0 | 12.12 | 10.16 | ..... | ..... |
| 1-1-1½ | 11.81 | 9.75 | 5200-4500 | 4600-3700 |
| 1-1-2 | 11.18 | 9.37 | 4900-4100 | 4000-3200 |
| 1-1½-3 | 10.09 | 8.69 | 4300-3500 | 3700-2900 |
| 1-2-3 | 9.80 | 8.50 | 3900-3100 | 3300-2500 |
| 1-2-4 | 9.35 | 8.22 | 3300-2500 | 2800-2000 |
| 1-2½-3½ | 9.42 | 8.29 | 3300-2500 | 2700-1900 |
| 1-2½-4 | 9.21 | 8.15 | 3100-2400 | 2600-1800 |
| 1-2½-4½ | 9.09 | 8.09 | 2900-2200 | 2500-1700 |
| 1-2½-5 | 8.83 | 7.89 | 2700-2100 | 2300-1600 |
| 1-3-5 | 8.72 | 7.83 | 2300-1600 | 1900-1300 |
| 1-3-6 | 8.45 | 7.64 | 2300-1500 | 1800-1100 |
| 1-4-7 | 8.13 | 7.45 | 1500-1000 | 1200- 600 |




*Concrete mixing plant and one edge of storage yard*

# Hard-Surface Alloys Reduce Crushing Plant Repair Costs

By Charles Jenkins
Superintendent, Pacific Minerals Co., Ltd., Barstow, Calif.

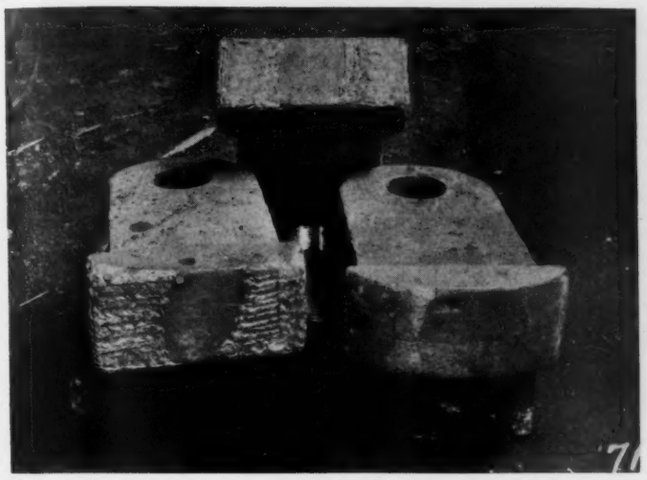


*Fig. 2. Hammer-mill hammers with welded-on surfaces*

*Fig. 3. Breaker plate hard surfaced*

IF you were crushing, grinding and screening rock to make roofing granules in the Mojave Desert you would be interested in getting the maximum life from your equipment. That's my job. In Rock Products, July 18, 1931, I described the Calico Canyon deposit of stone we quarry, 24 miles east of Barstow, Calif., and the crushing and screening plant, in the Mojave Desert.

I have found that by the use of one of the various hard surfacing alloys, welded on, I can increase the life of numerous parts of our crushing and handling equipment from two to four times, thereby reducing replacement costs and delays. The alloy I have used is "Stoodite," made in Los Angeles. Some examples of work done in our plant with this alloy are shown in Figs 1-6 inclusive.

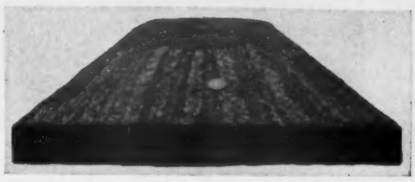


*Fig. 1. Breaker plate faced with welded-on surface*

Fig. 1 shows a breaker plate faced with Stoodite; Fig. 2 shows hammer-mill hammers faced with the same material; Fig. 3 shows a breaker plate faced with Stoodite; Fig. 4 shows Stoody self-hardening material applied to a gyratory crusher mantle; Fig. 5 shows a gravel screen and a pump runner, both of which have been faced with Stoody self-hardening rods; Fig. 6 shows the lip of an elevator bucket built up with "Tube Barium," and a new bucket. These buckets show the wear, after a time run test, both being in No. 1 condition at beginning of the run. These pictures clearly demonstrate the economy of the application of the above named materials, which are daily helping the plant operators in their battle with reduced manufacturing costs.

### *The Beauties of the Desert!*

Does the mention of the name Mojave Desert bring to your mind a picture of simmering sands, sun baked rocks, bleached bones, a place God left for the devil? If this is your mental vision of this desert, it is a wrong vision. At present writing the desert is abloom with myriads of wild flow-

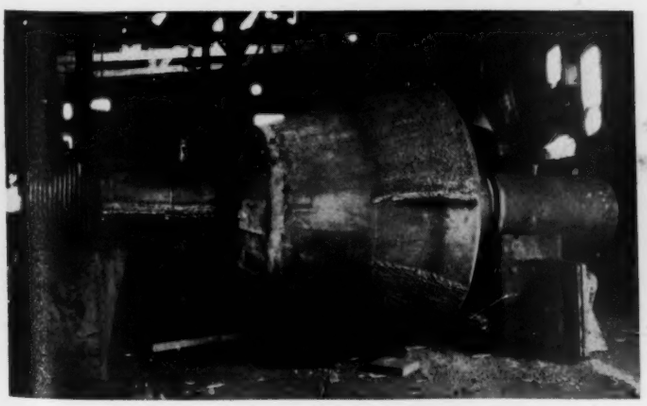


*Fig. 4. Crusher mantle with self-hardening alloy wearing surface*

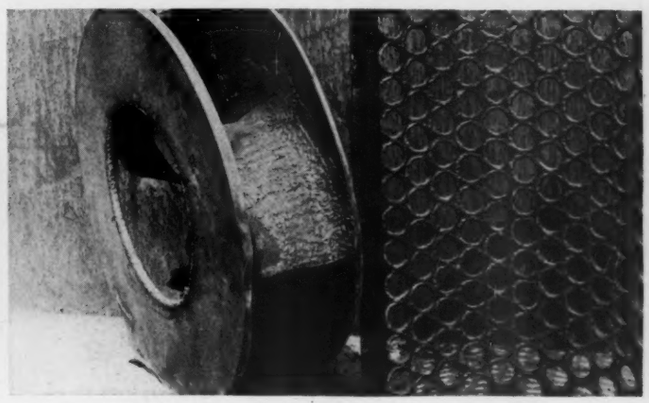


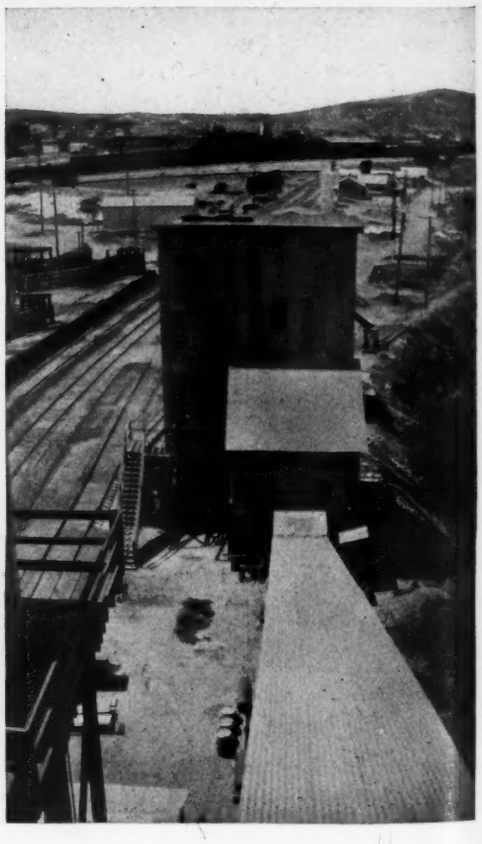
*Fig. 5. Pump runner and perforated metal screen with wear-resisting alloy welded on*

ers, the like of which can only be found on the desert. True, the rattlesnakes and all the scaly monsters who inhabit the sands and rocks weave their way among the flowers, but they cannot detract from the beauty that is here. The highways penetrating these sandy stretches for hundreds of miles eliminate the dread of this country. One can today travel hundreds of miles across this land that a few years ago would have taken months to traverse. Today the desert has become an outing place for those who have grown tired of the beaches and mountains. Up-to-date modern towns are located at convenient intervals for the comfort of visitors on good roads where formerly were only drifting sands.

***A Rock Products Paradise!***

There is considerable mining being done. This includes small mines operating on quartz as well as placers. The desert is a ve melting pot of nonmetallics, which clays of all descriptions, borax, bari talc and soapstone, tripoli, salt, potash and numbers of others too numerous to mention. Some scientists claim that this desert is the newest part of the continent; that is, it was the last part of the country to be formed. The La Brea asphalt pits, the volcanic cinder cones, many of which are visible within a radius of a few miles from the town of Barstow, prove this contention. About 12 miles northwest of Barstow exists what was at one time a mud volcano. During the eruption of this volcano countless prehistoric animals roamed the immediate vicinity. No doubt the eruption came on so suddenly these animals had no chance to escape from the hot mud and were consequently buried. Many fossils have been found. The Smithsonian Institute has a crew of men unearthing these fossilized animals at the present time. A curious thing about the skeletons is that they have all turned to stone.

The accompanying pictures of the plant of the Pacific Minerals Co., Ltd., give you an idea of the desert. The craving for the beautiful has forever been satisfied, regardless of how far one had to go to obtain what was necessary to satisfy this human taste. This company transports beautiful



***Mine bins, transportation truck and plant of the Pacific Minerals Co., Ltd., in the Mojave Desert, California***

***Fig. 6. Built-up bucket (above) and new bucket (below)***

red rock a distance of 24 miles across these hot sands to the plant to be manufactured into rock granules, which are then shipped to the various roofing manufacturers on the coast, to be made into the attractive shingles you see on modern homes today.

## Use of Oyster Shells in Poultry Feed Grows

THE VALUE of oyster shells to the producer of oysters has increased from less than $100,000 in 1918 to approximately $2,000,000 in 1931, and in the same period an export business has been developed which reached its peak last year with the shipment abroad of oyster shells valued at $514,704, according to information made public, June 15, by the Department of Commerce. Much of this growth has been the result of research conducted by the United States Bureau of Fisheries in cooperation with various seacoast states, it is pointed out.

Several years ago oyster shells were used primarily for road construction, but scientific investigation disclosed that these shells contained many important values for poultry feed, including lime. Today, such shells are considered a necessary ingredient in practically all mixed poultry feeds, supplying the necessary lime for the formation of egg shells.

Although there was a slight decline in the value of oyster shells to the producers in 1931 compared with earlier years, exports were greater in 1931 than ever before. Exports last year totaled 53,189 tons valued at $514,704 compared with 49,533 tons valued at $496,302 in 1930, and 42,749 tons valued at $443,789 in 1929.

About three-fourths of the oyster shells exported from the United States is purchased by the United Kingdom. Other purchasers are Canada, Belgium, Germany and the Netherlands.

## Gypsum Industry in 1931

TO SUPPLY the mineral industry with data on gypsum production and markets during the past year, the following information, which has been collected in cooperation with the geological surveys of Iowa, Kansas, Michigan, New York, Oklahoma, South Dakota, Texas and Virginia, is furnished by the United States Bureau of Mines.

The gypsum industry continued to decline in output and value of product. The quantity of gypsum mined in the United States in 1931 was 2,559,017 short tons, a decrease of 912,376 short tons, or 26%, compared with 1930. This production was the smallest since 1919 and was 55% less than that of 1925, the year of maximum output, and was 11% less than that of 1921.

The total value of the calcined and uncalcined gypsum sold by producers was $20,801,357, a decrease of $6,250,127, or 23%, compared with 1930. The quantity of gypsum sold by producers without calcining in 1931 was 773,185 short tons, a decrease of 216,406 tons, or 22%, compared with 1930, and was valued at $1,565,367, or $2.02 per ton, a decrease of $320,887, or 17%, but an increase of 11 c. per ton; the quantity of calcined gypsum sold by producers was 1,593,753 tons, a decrease of 597,623 tons, or 27%, and was valued at $19,235,990. This was a decrease of 24% in total value compared with 1930.

New York continues to be the largest producer of gypsum. The production of crude gypsum in that state in 1931 was 744,613 tons, a decrease of 18% from that of 1930. This was 29% of the entire quantity mined in the United States. New York is also the largest seller of gypsum, marketing 222,072 tons without calcining, or 29% of the United States total, and 459,676 tons calcined, or 29% of the total. These figures represent a decrease of 19% in the uncalcined and 20% in the calcined gypsum produced compared with 1930. Other important states in the production of crude gypsum in 1931 were Michigan, 383,123 tons; Iowa, 321,627 tons, and Texas, 239,391 tons. These states reported 66% of the total production of crude gypsum in 1931.

The importation of gypsum constitutes quite an important factor in the industry. In 1931 eight importers with 13 plants in ten states, namely, California, Connecticut, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Vermont, Virginia and Washington, reported to the Bureau of Mines that they imported 630,892 short tons of crude gypsum, a decrease of 21% compared with 1930. These importers reported 78,258 tons of gypsum sold uncalcined, valued at $317,190, a decrease of 16% in quantity and 19% in value compared with 1930. The imported gypsum sold calcined in 1931 amounted to 538,633 tons, valued at $7,602,117, a decrease of 17% in quantity and of 7% in value compared with 1930.

## Cement and Lime Production in Canada

*Cement*—Shipments of portland cement by Canadian producers totaled 427,320 bbl. in April, according to the Dominion Bureau of Statistics at Ottawa. During March the production amounted to 276,172 bbl.. During the first four months of 1932 the Canadian production of portland cement was 45.1% below the shipments in the corresponding period of the previous year.

No portland cement was exported from Canada during April; in the preceding month 379 bbl. were exported. Portland cement imports were recorded at 2728 bbl., made up of 1900 bbl. from Denmark, 600 bbl. from the United States, 163 bbl. from Great Britain and 65 bbl. from Japan.

*Lime*—Lime producers in Canada reported shipments totaling 26,744 tons during April. During the first four months of the current year 103,169 tons were shipped as compared with 109,976 tons in the corresponding period of 1931.

Exports of lime in April amounted to 391 tons. Imports of lime were recorded at 28 tons.

## Canada's Mineral Products in April

THE DOMINION Bureau of Statistics at Ottawa reports production as follows on nonmetallic minerals:

PRODUCTION OF MINERALS IN CANADA

| | | April, 1932 | Four months ending April, 1932 |
|---|---|---|---|
| Asbestos | tons | 8,830 | 35,663 |
| Cement | bbl. | 427,320 | 1,210,151 |
| Feldspar | tons | 415 | 3,320 |
| Gypsum | tons | 23,087 | 46,161 |
| Lime | tons | 26,744 | 103,169 |

GYPSUM MINED AND UNCALCINED GYPSUM SOLD BY PRODUCERS IN THE UNITED STATES IN 1931, BY STATES

| State | Number of operators | Total quantity mined (short tons) | Sold without calcining Short tons | Sold without calcining Value | Sold calcined Short tons | Sold calcined Value | Total value of sales |
|---|---|---|---|---|---|---|---|
| California | 5 | 90,899 | (*) | (*) | (*) | (*) | $ 472,015 |
| Iowa | 7 | 321,627 | 98,474 | $134,128 | 210,726 | $2,453,998 | 2,588,126 |
| Michigan | 5 | 383,123 | 136,060 | 253,842 | 253,902 | 3,284,044 | 3,537,886 |
| Nevada | 4 | 131,079 | 41,969 | 118,339 | 71,706 | 674,147 | 792,486 |
| New York | 10 | 744,613 | 222,072 | 485,904 | 459,676 | 5,625,949 | 6,111,853 |
| Texas | 5 | 239,391 | 55,581 | 94,768 | 157,556 | 2,025,440 | 2,120,208 |
| Utah | 3 | 22,178 | 5,837 | 17,391 | 13,199 | 116,142 | 133,533 |
| Other states† | 15 | 626,107 | 213,192 | 460,995 | 426,988 | 5,056,270 | 5,045,250 |
| | 54 | 2,559,017 | 773,185 | $1,565,367 | 1,593,753 | $19,235,990 | $20,801,357 |

*Included with "Other States."
†Includes Arizona, Colorado, Kansas, Montana, Ohio, Oklahoma, South Dakota, Virginia and Wyoming.

# Lubrication of Wire Ropes

By James I. Clower

WIRE ROPES require care and attention if long life and satisfactory service are to be secured. Of the several factors affecting the useful life of a wire rope, none is of greater importance than that of lubrication. Carefully kept records show that the useful life of a wire rope may be increased from two to four times by proper systematic lubrication.

A wire rope has wearing surfaces in close contact and usually under heavy pressure, especially if the ratio of the diameter of the sheave to that of the rope is small. As a result, films of oil are necessary between the surfaces to prevent wear and to exclude moisture and other corrosive substances that may tend to work in between the wires.

The total area of the wires exposed to wear and corrosion is very large. For example, in a 1-in., six-strand rope, 100 ft. long, the total area is about 110 sq. ft., assuming seven wires per strand; for 19 wires per strand, the area is 250 sq. ft. The visible external surface is, however, only about 35 sq. ft. It is seen, therefore, that the area requiring protection is quite large, even for a short rope.

External wear and corrosion of a wire rope is easily seen, but when such damages occur internally, the rope may be seriously weakened without detection. For this reason, *internal lubrication* is most important.

When wire ropes are manufactured, the hemp core is saturated with a heavy oil which provides initial protection, but when they are stored for long periods or exposed to heat, a part of the initial charge of oil often runs out, leaving the wires unprotected. This initial charge of oil also soon works out in service, exposing the surfaces to the corrosive action of moisture and other harmful agents.

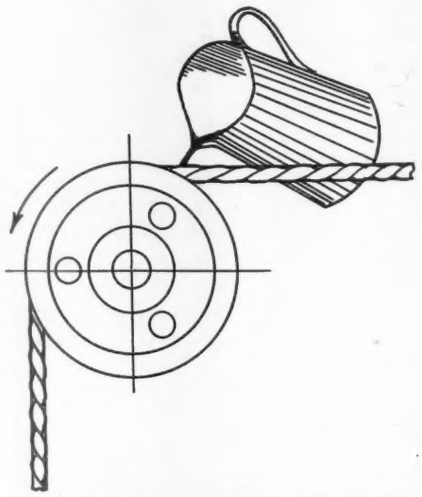


***Fig. 1. A simple method of hand oiling wire rope***

Corrosion is perhaps the most common cause of wire-rope deterioration. Moisture penetrating the rope fills all free spaces between the wires and enters the hemp core. The outside surfaces dry quickly, but the voids and hemp core retain the moisture, thus accelerating rust and pitting of the surfaces of the wires. This causes a decrease in the net cross-sectional area of the rope, in consequence of which it is weakened and damaged.

A second cause of corrosion is wear. This is not confined to the exterior surfaces. As the rope is flexed under stress over sheaves and drums, the wires slide or rub over one another, causing internal wear that is not easily seen. Such wear is more rapid when the rope is exposed to abrasive dust and grit, which work into the spaces between the wires.

### *Purposes of Lubrication*

The lubricant used for wire rope must properly perform three major functions, as follows:

(1) Provide strong, tenacious oil films over all surfaces, effectively lubricating the individual wires and the wearing surfaces of drums and sheaves, thereby minimizing wear and friction.

(2) Fill completely the free spaces between all wires, thus excluding moisture, dust, grit and other destructive substances.

(3) Saturate the hemp core, providing a reserve supply of lubricant and maintaining the core soft and flexible.

A correct lubricant so applied that it will creep into and fill the voids and saturate the hemp core replaces losses of the initial charge of oil, excludes moisture, sand and dirt, protects the interior surfaces from corrosion, and lubricates the rubbing surfaces of the wires. It also lubricates the outer surface by coating the rope and the grooves of the sheaves and drums with films of oil.

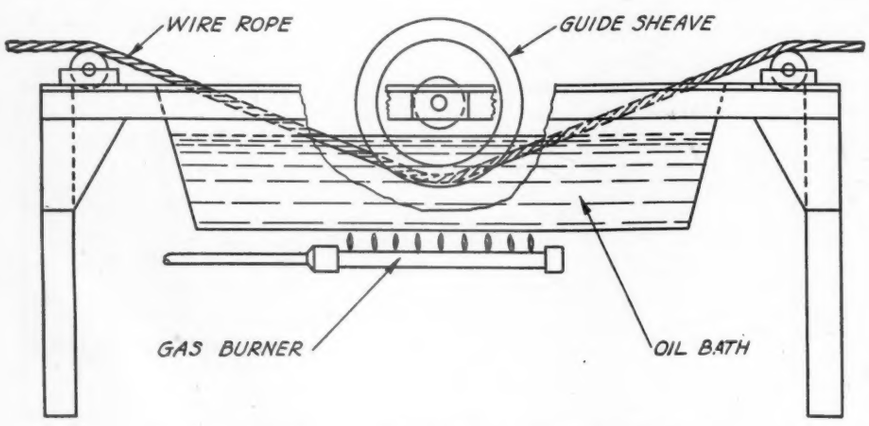



***Fig. 2. An efficient device for applying oil to wire rope***

### *Oil Requirements*

In order to perform the above three major functions, the lubricant must have certain characteristics.

The ability to penetrate into small spaces is perhaps the most important property of a wire rope lubricant. As penetration is greatly influenced by fluidity, it is desirable from this standpoint to use a comparatively light-bodied oil. Unfortunately, it is not possible to obtain a relatively light-bodied oil of high penetrating ability and also of sufficient body and tenacity to withstand the severe service to which wire rope is generally exposed.

To provide films capable of sustaining heavy pressures, resisting the throwing-off effect of centrifugal force and the washing action of water and remaining in place, the lubricant must have a heavy body and adhesiveness or tenacity. Heavy body without tenacity is not sufficient. For example, greases possess heavier body or consistency than residual petroleum oils, yet experience has demonstrated that they do not meet the requirements of a good wire-rope lubricant.

It might be thought from the above that a compromise would have to be made when selecting a wire-rope lubricant. However, this is not altogether true, since the fluidity of all petroleum products increases with temperature, and it is therefore possible to select a heavy, residual oil and, by applying it hot, secure efficient distribution and thorough penetration. Attempts have been made to use a light-bodied oil for internal lubrication and a heavy-bodied oil for the outside coating, but this has not been satisfactory because of the lighter oil working out and destroying the tenacity of the heavy surface coating.

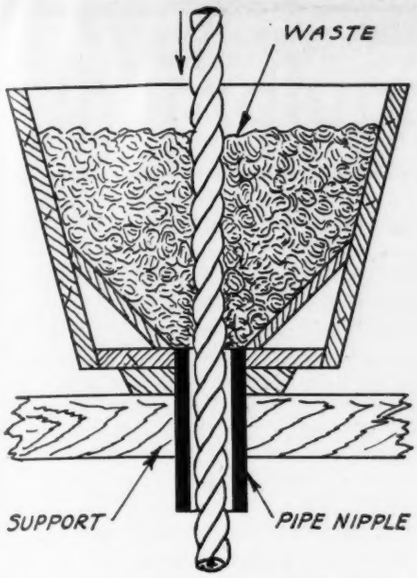



***Fig. 3. Cheap wooden box for applying oil to vertical wire rope***

Experience shows that for *moderate and severe duty conditions* a heavy-bodied, tacky, residual, pure petroleum product having a viscosity of approximately 1000 sec. Saybolt at 210 deg. F. and flash and fire points of approximately 450 and 540 deg. F. respectively is admirably suited for wire ropes. This product should, of course, be non-corrosive, non-gumming, non-drying and not ball-up with dust and other impurities. Moreover, it should be of such a character that its structure is not injured by heat and be capable of returning to its original consistency upon cooling.

Obviously, greases and similar compounds are not capable of fulfilling these requirements.

For *light-duty conditions* and where it is impossible to heat a heavy-bodied product such as described above, a comparatively light-bodied mineral oil may be used with satisfactory results.

For these conditions a dark lubricating oil having a viscosity of approximately 1800 sec. Saybolt at 100 deg. F. and 100 sec. at 210 deg. F. will give efficient lubrication. It should, of course, possess the same general characteristics as the heavier-bodied oil.

Such an oil will creep when cold in between the wires and saturate the core; it will, however, require quite frequent applications. When the rope is in continuous service it may be necessary to apply this oil every day, or every other day at the most.

### *Methods of Application*

Two general methods are used in applying oil to wire rope; first, hand oiling; second, application by means of an oiling device of some kind.

Hand oiling is the most common, but the least efficient, method because much oil usually runs to waste, and unless diligently done the oil does not thoroughly seep into the rope. However, if reasonable care is taken, the following hand oiling methods serve when it is impractical to apply the oil by a more efficient method.

The oil may be poured in a very small stream into the groove of a sheave (Fig. 1) just where the rope makes contact. In this way the oil is spread and is worked, to a certain degree, into the rope.

A dipper or cup may be used to pour oil on to the rope as it travels slowly along. The oil should then be rubbed into the strands by means of waste or, preferably, a piece of sheepskin with the wool next to the rope. A pan should be placed under the point of application to catch the excess of oil.

A brush, a bunch of waste or a sheepskin which has been soaked in the oil may also be used for applying the lubricant.

*In any case of hand oiling, the important thing is to thoroughly work the oil into the rope.*

### *Oiling Devices*

The best method of lubricating wire rope is to immerse it in a bath of oil of proper characteristics, heated to a temperature where it will readily penetrate to the core. After draining off the surplus oil, the internal and external surfaces will be covered with tough oil films protecting the rope against wear and the elements for a long time.

A metal trough, as shown in Fig. 2, is easily built and furnishes a convenient means for applying the oil to ropes that run horizontal with slack. A wiper should be used on the outgoing end of the trough so excess oil will be removed and returned to the trough and not wasted. Best results are obtained by passing the rope through the oil bath slowly, as more thorough lubrication and greater penetration will thus be attained.

Where the rope may be removed from its drums and sheaves, a most satisfactory method is to heat the oil in a large open tank and immerse the coil of rope for a sufficient time to permit the oil to soak thoroughly into it.

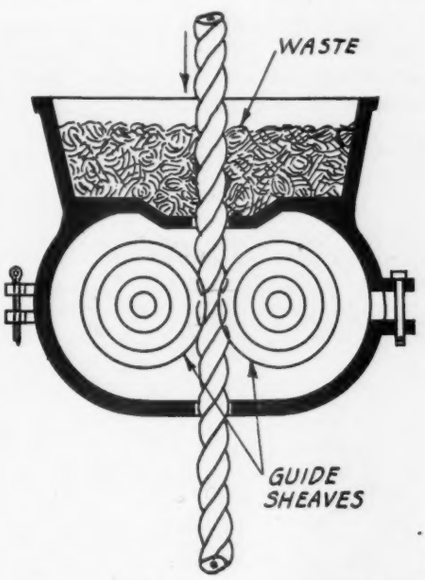



***Fig. 4. Cast-iron device for applying oil to vertical wire rope***

For vertical ropes, the lubricating devices shown in Figs. 3 and 4 will be found efficient and convenient.

Another method of applying oil to wire rope is by the use of compressed air. The rope is first cleaned by high pressure air jets and the oil is then projected against it by a number of jets of compressed air. The heated oil is thus thoroughly atomized and forced into all sides of the rope. Efficiency and economy have been claimed for this method.

In all cases it is very important that the rope be thoroughly cleaned before applying the oil. This may be done by soaking in kerosene for a few hours and then scrubbing with a stiff wire brush. A little extra time and effort spent in preparing the surface for the application of fresh oil will add weeks to the life of the oil films, thereby reducing the number of applications and quantity of oil to a minimum.

## Judge Rules County Cannot Condemn Gravel Pit

JUDGE W. J. KNEESHAW declared that the right of a county to condemn gravel pits for county highway use was unconstitutional in a decision at Grafton, N. D., at a special term of court. This decision came as a result of litigation entered into by the Becker County Sand and Gravel Co. of Detroit Lakes, Minn., and the Walsh county, North Dakota, board of commissioners over the condemnation of the Poole gravel pit at Forest River from which it was intended that gravel would be secured for the surfacing of Highway No. 44.

This action will hold up the graveling of No. 44 indefinitely. However, it is reported that officials believe that the state highway commission will take steps to secure the gravel from another pit, the *Grafton Leader* reports. According to the *Grand Forks* (N. D.) *Herald* this attempt to condemn the deposit of the Becker company was made after the county commissioners rejected bids on its gravel requirements to be supplied from the pit by the Becker County Sand and Gravel Co.

## Kentucky Road Building Now at Highest Level

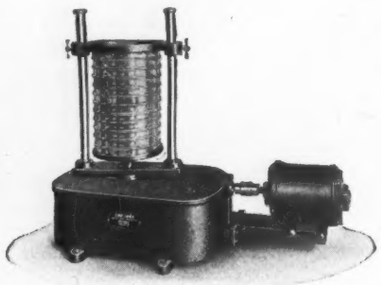
THE volume of road construction under way in Kentucky at the present time exceeds any ever before undertaken by the state, according to an announcement by Ben Johnson, chairman of the State Highway Commission.

More than 1100 miles of public roads are now under construction, the cost of which, he said, will be $9,021,794. During the next two years the highway commission will spend $32,192,000 in the construction, maintenance and repair of state roads and administration, Mr. Johnson stated.

# New Machinery and Equipment

## Testing Sieve Shaker

THE Newark Wire Cloth Co., Newark, N. J., announces the "End-Shak" testing sieve shaker, which is claimed to reduce the operating time necessary to complete a test.



***Testing sieve shaker***

Features claimed for the machine are that it eliminates most of the variable factors in sieve testing and that it brings the results of laboratory and plant into closer relationship. The device weighs 275 lb. and is driven by a ¼-hp. motor. A standard auto time switch automatically controls the period of the test. It is adjustable to hold any number of sieves from 1 to 13.

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## Extensometer

THE OXWELD "Extensometer," a new testing device which makes it possible to determine the yield point of specimens being tested in an Oxweld portable tensile testing machine, is announced by the Linde Air Products Co., New York, N. Y.

The sensitivity of the Oxweld "Extensometer" is said to be such that it will indicate the elongation in a standard A. S. T. M. test specimen occasioned by the heat of the human hand. Although highly sensitive, this instrument is simple, rugged, self-contained and self-compensating, the manufacturer states.

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## One and One-Half Ton Truck

THE Autocar Co., Ardmore, Penn., announces its Model R 1½-ton Autocar. It is a 6-cylinder dual-rear-wheel truck with standard wheelbases of 159, 171 and 189 in. Its gross weight is 14,000 lb.

It is powered by a newly designed Autocar Blue Streak engine with piston displacement of 314 cu. in. and horsepower rating of 33.75. The engine yields 75 b.hp.

Power application is through an Autocar 4-speed transmission with low ratio of 6.41 to 1 and a direct high gear. At its governed speed the loaded truck is good for 45 mi. per hr. and a grade of 4.8% in high gear, the manufacturer states.

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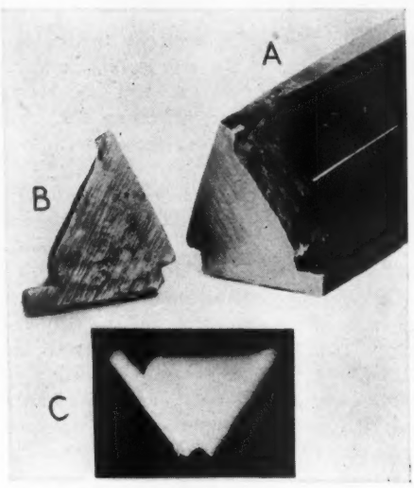
## Rod for Electric Welding Stainless Steels

A NEW Allegheny metal-welding electrode is announced by Joseph T. Ryerson and Son, Inc., Chicago, Ill. The rod is applicable to Allegheny metal and other stainless steels in the 18-8 chrome nickel group. The manufacturer states that it has been established that the rod will give uniform, highly satisfactory results.




***Illustrating use of rod for electric welding***

A special flux coating is said to produce a non-active gas which surrounds the hot metal and prevents the oxygen of the air from attacking the metal and forming oxides. The heavy slag formed on top of the weld acts as a protective agent as the metal cools.

When welding with this electrode it is unnecessary to remove the slag before the next bead is laid down. Tests indicate carbon increase in bead of about 0.01% as compared to the original rod.

The illustration shows a V-type fill of eight layers placed one on top of the other without removal of any slag. *"A"* is the welded material from which section *"B,"* ⅛ in. thick, was hack-saw cut across the weld. *"C"* is an x-ray picture of *"B,"* showing the perfect bond between the rod and work.

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## Patent Suits on Lubricated Valve Settled

ANNOUNCEMENT is made that patent suits between the Merco Nordstrom Valve Co. and the Walworth Co. have been terminated and cross-licensing arrangements have been made whereby the Walworth Co. is authorized to use the "Sealdport" and other patents of the Merco Nordstrom company.

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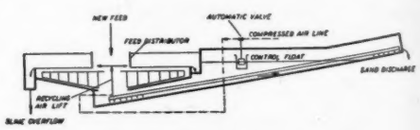
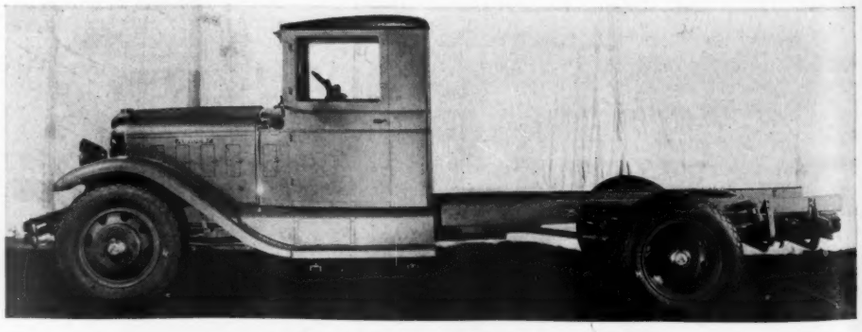
## Critical Size Control

A DEVICE, the Dorr "Critical Size Control," has been announced by the Dorr Co., Inc., New York, N. Y., and is for use in improving the general operation of bowl classifiers and the rotary mills with which they operate in closed circuit. The device




***Device for increasing classifier efficiency***

may be attached to existing installations or it may be supplied with new ones. Advantages claimed where experimental installations have been made are: Increase in classifier efficiency circulating sand load and grinding capacity; reduction of oversize in finished product; and reduction of finished products



***Six-cylinder dual-rear-wheel 1 1/2 ton truck***

in sand discharge. The principle upon which it is based is that by recycling material of critical size which tended to collect as a mass in the lower end of the classifier under carefully and automatically controlled conditions, each particle is given several additional classifications, and hence opportunities to leave the circuit as a finished product.

In operation, the critically sized material in process of recycling is elevated from the reciprocating rake compartment to the bowl of an air lift and the rate of recycling is determined by the amount of compressed air admitted thereto. This in turn may be controlled by a manually operated air valve or by an automatic valve operated by a float in the raking compartment. The automatic valve is adjusted to hold the difference in elevation at the optimum value. It is reported that an installation in the Kirkland gold fields improved operating results by 5.9% in over-all capacity of the bowl classifiers, 17.3% increase in production of minus 200-mesh finished material, and an increase of 53% in circulating load ratio.

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## New Price Schedule Announced

THE Carboloy Co., Inc., a subsidiary of the General Electric Co., Schenectady, N. Y., has announced a general reduction in the price of Carboloy cemented carbide tools and raw metal. Carboloy is a comparatively new alloy developed for use as an extremely hard, wear-resistant material for metal cutting purposes.

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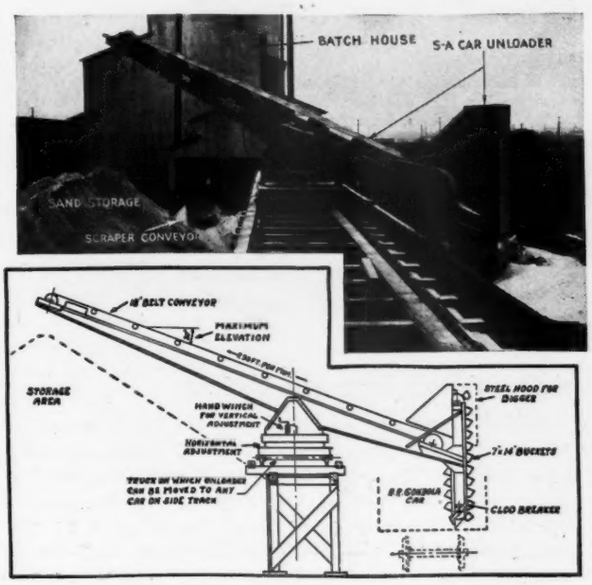
## Portable Car Unloader

AN INGENIOUS portable machine was recently built by Stephens-Adamson Mfg. Co. of Aurora, Ill., to handle damp silica sand for a glass plant. This particular unloader will unload and clean up a 50-ton car in approximately an hour and is handled by one operator. In addition to discharging cars, a conveyor unit on the machine carries the material to storage or stockpiles 20 to 30 ft. from the track siding.

As shown in the illustration, the machine consists of a continuous bucket digger with clod breakers mounted on the end of an 18 in. by 36 ft. belt conveyor. The whole unit is counterbalanced and pivoted on a flanged wheel truck that can be moved to unload any gondola on the spur track. When once unloaded to storage piles, the material can be moved or reclaimed to the plant by a drag scraper conveyor, as shown.

Although this installation is unloading damp sand, there seems to be no reason why the arrangement could not be used for any bulk material, provided the lumps were not too big to be handled by the digger buckets.




***Machine unloads 50-ton car in an hour***

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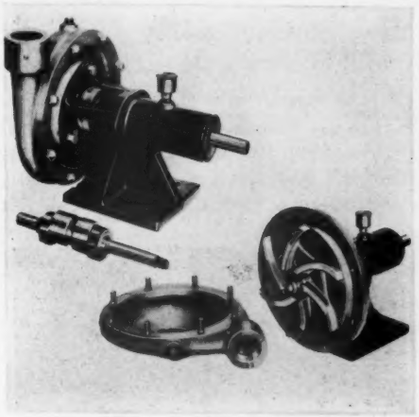
## Centrifugal Pump

A BALL-BEARING centrifugal pump is announced by the Hills-McCanna Co., Chicago, Ill. The ball bearings are designed to carry the load in any direction. The stuffing box is of the split screw gland type



***Ball-bearing centrifugal pump***

and there is no bearing back of the packing. Parts coming in contact with the liquid can be made of any machineable ferrous or nonferrous alloy. The pump has removable inboard and outboard heads, that it may be adapted to the handling of corrosive fluids. All parts are made to gage and are interchangeable. They are available with or without motor drive.

## Lightning Immunization

ALMOST complete immunity from lightning failures and a reduction in fuse blowing, as well as a lowering of installation cost, is claimed for a new scheme of interconnection of distribution transformers and lightning arresters the General Electric Co., Schenectady, N. Y., has announced. These lightning arresters are suspended inside the transformer tanks.

The arresters are connected to the incoming high-voltage lead and the grounded lead on the low-voltage side, the usual ground connection for arresters being omitted. They can be installed in modern pole-mounted transformers without change while steel transformer tanks fabricated within the past two years or more have been designed with such in mind.

In the new scheme the tank is left ungrounded in accordance with customary practice, but the secondary must be thoroughly grounded.

The arresters, completely assembled and especially designed for this application, are being produced for 2400- and 4800-volt service. They are of Thyrite, a material that is both an insulator and a conductor of electricity.

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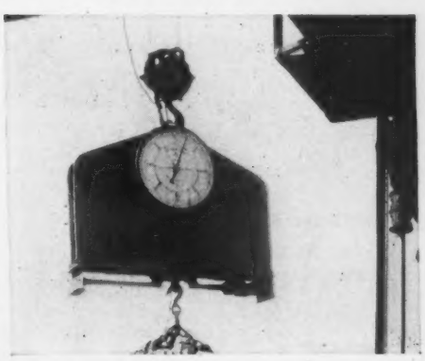
## Crane Scale

A SCALE which can be attached to cranes is announced by the Kron Co., Bridgeport, Conn. This crane scale is placed in the lifting line and becomes a part of the line itself. A large indicating dial registers the



***Scale for use on cranes***

weight as soon as the load is clear of the ground and continues to do so until the load is again deposited. The weight may thus be read at any point in the travel of the load. This scale is made in a regular type for general use and a low-head type for use where head room is limited. Either type is available in capacities from 750 to 50,000 lb.

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## New Drill Steel Plant

THE Paragon Steel and Tool Co. has completed the installation of its machinery for forging its "Swede Steel" products in its new factory at East Rutherford, N. J., and has started operation of its plant.

## New Oregon Aggregates Producer Starts Operation

ORGANIZATION of the Roseburg Sand and Gravel Co., Roseburg, Ore., was completed on June 9 with the filing of the firm name. This company, headed by E. R. Metzger and W. J. Adair, is furnishing the rock, sand and gravel for the construction of the northwest national soldiers' home, as well as selling sand, gravel and crushed rock for all general purposes.

The company's plant has recently been put in operation about 4 mi. west of Roseburg on the South Umpqua river, where an unlimited supply of excellent rock and sand is available. This bar is one of the largest in the county, and it is expected that the plant can be operated there for a great many years.

The gravel is taken from the bar by a dragline, which will be electrically operated. The dragline carries the sand and gravel to a dump, from which it is carried to the top of a 44-ft. tower by an electrical skip hoist.

The material is washed and then passes through a screen, where it is graded into four sizes. The sand is washed again and automatically deposited into a storage bin.

The over-size gravel passes over the first screen to the crusher, where a Universal jaw crusher and a Symons cone crusher reduce it. Conveyors then take the crushed rock back to the screen, where it is sorted into four sizes, and over-size returns to the crusher for a second reduction.

Three men can operate the plant at its full capacity of 350 yd. daily, the *Roseburg News* reports.

## Seizure of Cement Mill in Mexico Enjoined

DISTRICT Judge Florencio Araiza at Pachuca recently granted an injunction against expropriation by the State of Hidalgo of the Cruz Azul cement factory. The state will appeal to the Federal Supreme court here to pass on the constitutionality of the expropriation law.

The Hidalgo state legislature, following discovery there of some of the richest silver mines in the world, enacted an expropriation law under which virtually any industrial or commercial enterprise deemed by the governor "a public utility" might be taken over by the state. The law provided for the payment in cash of 3% assessed valuation of the property seized, and the balance over a period of years with interest at 4%.

The Tolteca Cement Co. bought out the Cruz Azul concern, closing the plant and leaving its workmen without employment. The laborers concluded the Tolteca company sought a monopoly.

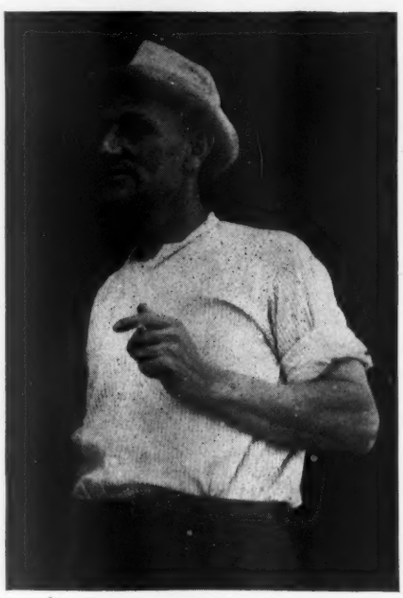
The state government declared the property expropriated and proposed to hand it over to the workers to operate on a cooperative basis.

The closing of the factory left 300 men out of work and meant the virtual disappearance of the village of Jasso.

The State of Vera Cruz has on its statute book similar if not more drastic measure. The Federal court's decision in the Cruz Azul case, therefore, may have a far-reaching effect on the status of foreign investments in Mexico's two richest states. President Ortiz Rubio has clearly indicated he does not approve such measures as those adopted by Hidalgo and Vera Cruz.—*New York* (City) *Times.*

## New Superintendent for Rock Hill Quarries, St. Louis, Mo.

IT HAS recently been announced that C. E. Glassen has been appointed general superintendent for all the quarries of the Rock Hill Quarries Co. of St. Louis, Mo. Besides being in charge of the plants of this company, Mr. Glassen will also superintend the operation of the plant of Denton Sand and Gravel Co. at Pacific, Mo. This company is controlled by the quarry company. Mr. Glassen was formerly superintendent and engineer for the Columbia Quarry Co., St. Louis.



***C. E. Glassen***

## Distinguished Japanese Visitor

S. NAGAI, professor of chemical engineering at the Imperial University of Tokyo, and a well-known authority on the chemistry of portland cement, was a recent visitor of Rock Products in Chicago. He is returning to Tokyo from two years spent in study and research on industrial chemistry in Germany.

## Fire Destroys Part of Rockland, Me., Lime Plant

TWO hydrate mills, operated and owned by the Rockland and Rockport Lime Corp., Rockland, Me., were destroyed, July 8, in a spectacular water-front fire, which resulted in a general alarm and necessitated the use of practically all the department's apparatus.

The large steel barge *Rockland,* docked at the wharf on which the mills are located, was damaged to the extent of about $500 and the fire extended to the carpenter shop.

An estimate of the total loss was about $100,000, which was partly covered by the corporation's blanket insurance.

The two hydrate mills were built in 1916 and 1918 and were mostly of corrugated iron construction. The fire was discovered at 4 a. m. in the wooden section nearest the harbor.

Both mills contained valuable machinery and a large lot of hydrated lime which was being shipped at the height of the season.

Fifty men were thrown out of employment, representing the bulk of the present payroll of an industry which employs 700 men in normal times.—*Boston* (Mass.) *Evening Globe.*

## Dr. George K. Burgess

ON JULY 2 Dr. George K. Burgess, director of the United States Bureau of Standards, died in Washington from a cerebral hemorrage. He was 58 years old.

Dr. Burgess graduated from the Massachusetts Institute of Technology in 1896. After receiving his doctor's degree from the Sorbonne, in Paris, he became associated with the Bureau of Standards in 1903 as associate physicist in charge of pyrometry, with which he has since been connected. In 1923, upon the resignation of Dr. S. W. Stratton, he was appointed as Director of the Bureau by President Harding.

Dr. Burgess was a member of numerous technical and scientific organizations in the United States. He had also received recognition for his technical knowledge in foreign countries. He was author of a number of technical articles.

## Pacific Coast Asbestos Association Meets

DELEGATES to the semi-annual summer meeting of the Pacific Coast Asbestos Association concluded their two-day conference at the Hotel Winthrop, Tacoma, Wash., June 24. The program, under the direction of Ralph Tomlinson of Portland, vice-president, and Arthur Knight of San Francisco, secretary-treasurer, was devoted to a discussion of greater use for asbestos insulation against heat and cold. At the conclusion of the sessions, the delegates left for their homes, to meet again at the annual meeting of the association in San Francisco in November.

# THE INDUSTRY

## Incorporations

**Super X Asbestos Co.**, Newark, N. J., $5000.

**Goran Silica Sand Co.**, Pacific, Mo. Warren W. Goran.

**Florida Trap Rock Sales Corp.**, Coral Gables, Fla. R. B. Owen and J. C. Sullivan.

**Merom Gravel Co.**, Indianapolis, Ind., reorganized. Capital stock, 500 shares at $50.

**Marion Fluorspar Co.**, Marion, Ky., $10,000. Avery H. Reed and Robert S. Mason.

**Wall Washed Sand and Gravel Co., Inc.**, Avonby-the-Sea, N. J., $50,000, 1000 shares common. Arthur M. Birdsall.

**Johns-Manville Corp.**, New York City, incorporated in Arizona. Lawrence Howe, Phoenix, Ariz., fiscal agent for Maricopa county.

**Haffner Sand and Gravel Co.**, Buck Hill, Ohio, 250 shares of no par stock. W. Bernard Rodgers, Lester P. Kauffman and Margaret L. Neel.

**Coral Reef Lime Products Co.**, Fresno, Calif., 960 shares of no par value. B. F. Mason, R. C. Finck and Herbert McDowell, Dinuba, Calif.

**Concho-Weleetka Sand and Stone Co., Inc.**, Oklahoma City, Okla., $25,000. Moore C. Hess, A. E. Perry and C. D. Bush, all of Oklahoma City.

**Campbellton Rock, Sand and Gravel Co.**, San Antonio, Tex., $4500. E. R. Breaker, R. G. Harris and U. S. Algee. To produce rock, sand and gravel.

**General Concrete Block and Coal Co.**, 12859 Carondolet Ave., Chicago, Ill., 100 shares of no par value. John L. and Caroline Pikul and Frank Wierzbienski.

**The McClamroch Co.**, Greensboro, N. C., 1000 shares of no par value. Julian Westwarren McClamroch, Charles H. White and Wilsie Glasgow of Greensboro, N. C.

**Carolina Supplies and Cement Co.**, Charleston, S. C., $40,000. Frank C. Ford, president and treasurer; J. Ross Hanahan, Sr., vice-president; George P. L. Murphy, secretary.

**Darnell Asbestos Co., Inc.**, 6061 N. Menard Ave., Chicago, Ill., $100,000. W. P. Darnell, Jr., Grace R. Kimball and Nicholas E. Kob. To manufacture and deal in asbestos products.

## Quarries

**Elberton Granite Co.**, Elberton, Ga., suffered a fire loss estimated at $10,000 on July 2.

**Oskaloosa, Ia.** Mahaska county rock quarry near Wright suffered considerable damage from floods.

**Braymer, Mo.** County is building two farm-to-market roads into Braymer using stone from local crushers.

**H. H. McGrath and Peter Duncan** opened a new quarry at Mountville, Ohio, to furnish crushed stone for local road work.

**Douds Stone Co.**, Douds, Ia., H. E. Millen, is reported running to capacity with two full shifts per day, largely on county road work.

**Oklahoma Limestone Products Co.**, Fort Towson, Okla., has been organized with Howard Wynn as manager to develop an agricultural limestone business.

**Colorado Fuel and Iron Co.**, Pueblo, Colo., is reported to be ready to start operation of its limestone quarry and crushing plant at Monarch, Colo., in the near future.

**Winlock, Wash.**, Lewis county, Rex Smith, road supervisor, reports that it is crushing rock at its plant for 30c. per cu. yd. for a daily capacity of 160 to 200 cu. yd.

**Baxter Chat Co.**, Baxter Springs, Kan., has leased the county rock quarry and crushing plant near Coffeyville, Kan., and expects to start crushing operations immediately.

**Winningham-Martin** quarry and crushing plant, Trenton, Mo., is reported to have installed a new hammer-mill and other equipment and will be turning out 150 cu. yd. per day. The rock is reported to pass state specifications for road work.

**Larimer and Shaffer**, Cedar Rapids, Ia., has begun operation of a new crushed stone plant on the east side of Cedar river near Cedar Rapids. They will begin delivery on a $40,000 crushed rock contract for Benton county. This firm is a well known sand and gravel producer and this is its first venture in crushed stone.

## Sand and Gravel

**Paducah Sand and Gravel Co.**, Evansville, Ind., has filed notice of final dissolution.

**Federal Materials Co.**, Cape Girardeau, Mo., has applied for permit to dredge sand and gravel from the Ohio river from Huntington, W. Va., to 208 miles up stream to a point near Wheeling, W. Va.

**Hutchinson Sand and Gravel Co.**, Dalton, Mass., suffered the loss of its garage, two Reo trucks, accessories and office equipment by fire on June 19. Estimated loss is $6000. The company will rebuild at once.

**Maunie Sand and Gravel Co.**, Carmi, Ill., suffered considerably when its unloading derrick on the river bank collapsed. Repairs were made immediately and the derrick was in operation again within 48 hours.

**Felton Sand and Gravel Co.**, Felton, Calif., has been purchased by R. M. Greathouse, formerly with the S. and M. Gravel Co., Oakland. Mr. Greathouse has had much experience in the production of sand and gravel. Among his other enterprises is the building and installing of log cabins.

**Waters and McCrary Gravel Co.**, Columbus, Miss., has taken over the operation of the New Hope Gravel Co. at Rucker, Miss. R. E. Lee will be sales manager. He formerly held the same position with the New Hope Gravel Co. W. J. Shackelford, vice-president of the New Hope Gravel Co., will remain in general charge.

## Cement

**Idaho Portland Cement Co.**, Inkom, Ida., has resumed operation of its plant.

**Pennsylvania-Dixie Cement Corp.** annóunces that it has placed its Kingsport, Tenn., plant in operation.

**Lehigh Portland Cement Co.**, Allentown, Penn., announces that its mills at New Castle, Penn., and Iola, Kan., have resumed operation.

**Ash Grove Lime and Portland Cement Co.**, Kansas City, Mo., announces that it has placed its Louisville, Neb., plant in operation.

**Three Forks Portland Cement Co.**, Hanover, Mont., is operating its plaster mill only, all cement orders having been transferred from the Hanover mill to that of Trident, Mont.

**Universal Atlas Cement Co.**, Chicago, Ill., has issued a little 16-page blue booklet entitled—"The Reasons Why the Depression Will Last Indefinitely." The pages of the booklet are blank.

**Southwestern Portland Cement Co.**, Osborn, Ohio, has brought suit for $34,591 against the R. P. Sebold Engineering Co., Dayton, for material furnished for highway construction last year.

**Columbia Cement Division** of the **Pittsburgh Plate Glass Co.**, Fultonham, Ohio, recently shipped two tows of cement, 1800 bbl. in all, on the Muskingum river from Zanesville to Washington county for state highway work.

**Crab Orchard, Tenn.** J. S. Cline has information showing the feasibility of construction of a portland cement plant here based on a report by Edward Barrett, state geologist of Indiana, on the limestone resources of this section.

**Superior Portland Cement Co.**, Superior, Neb., recently had a delegation of local citizens call on Governor Bryan to express their appreciation of the policy of giving preference to Nebraska materials for state highway construction.

## Gypsum

**Universal Gypsum and Lime Co.**, Akron, N. Y., received honorable mention in the national safety competition sponsored by the Bureau of Mines. The gypsum mine operated 60,365 man hours with no lost-time accidents in 1931.

**United States Gypsum Co.**, New Brighton, Staten Island, N. Y., is seeking reduction of the tax assessment on its property through action of the state Supreme court. The property of the company on Staten Island has been assessed at $1,375,000. The company is seeking a reduction of $462,000.

## Lime

**Roche Harbor Lime and Cement Co.**, Roche Harbor, Wash., held its annual celebration and picnic July 4 with its usual barbecue banquet of salmon and roast lamb.

## Concrete Products

**National Ready Mixed Concrete Association** has issued an attractive 4-page circular entitled—"A Concrete Story Told in a Concrete Way," being designed particularly for architects, engineers, contractors and home builders to explain the advantages of ready mixed concrete.

## Other Rock Products

**Northwest Magnesite Co.**, Chewelah, Wash., has resumed operation at its plant.

**Elyria Magnesium Products Co.**, Elyria, Ohio, was sold through court action to the Cheney Chemical Co. for $1800.

**Pacific Saline Chemical Co.**, Richmond Beach, Edmonds, Wash., has installed a $40,000 grinding plant to prepare for the market various nonmetallic minerals in eastern Washington.

**Southern Mineral Products Corp.**, Piney River, Nelson county, Virginia, a subsidiary of Vanadium Corp. of America, New York, N. Y., has resumed operations at its local phosphate works after a curtailment of several weeks.

**Hillside Flourspar Mines**, Chicago, Ill., has withdrawn, effective July 2, from the Oglebay, Norton and Co., Cleveland, Ohio, selling agent for fluorspar. Hereafter the company will handle all sales from its Chicago office, 38 S. Dearborn St.

**Solar Development Co.**, Paris, Bear Lake county, Idaho, which began development on a phosphate mine in 1930, is making shipments of phosphate rock to the acid phosphate plant of the Consolidated Mining and Smelting Co., Ltd., Trail, B. C.

## Personals

**Harlowe Hardinge**, vice-president and general manager, Hardinge Co., New York City, is in California on business. Before returning to the East, Mr. Hardinge will make a general inspection tour of the western territory.

**Martin H. Kidder**, Chicago, Ill., formerly with the advertising department of the Link-Belt Co., has established himself at 12238 Normal Ave. as a special press representative for machinery equipment manufacturers. Harnischfeger Corp., Milwaukee, Wis., is one of his clients.

**Carl D. Forsbeck**, field engineer, working out of the Seattle, Wash., office of the Portland Cement Association since 1924, has been appointed city engineer of Tacoma, Wash. Mr. Forsbeck is a graduate in civil engineering of Iowa State College and was engaged in county engineering work at Red Oak, Ia., for a number of years before he removed to Everett, Wash.

## Obituaries

**James Barrett**, veteran member of the staff of the Worthington Pump and Machinery Corp., New York City, died June 22 in Brooklyn, N. Y. He designed pumping equipment for many of New York's important buildings.

## Manufacturers

**Stephens-Adamson Manufacturing Co.**, Aurora, Ill., announces a new branch office at Rochester, N. Y., in the Cutler Bldg., with F. H. Wisewell, well known Rochester engineer, as district manager.

**Nordberg Manufacturing Co.**, Milwaukee, Wis., announces the removal of its New York City office from 51 E. 42nd St. to the Lincoln Bldg., 60 E. 42nd St. The company also announces the removal of its Los Angeles, Calif., office from 1462 Stanley Ave. to the Subway Terminal Bldg., 417 S. Hill St.

**Traylor Vibrator Co.**, Denver, Colo., has appointed Earl D. Stearns sales representative in the middle western states. Mr. Stearns has had many years of experience in contacting the rock products industry due to his former connections with the Stearns Conveyor Co., Robins Conveying Belt Co. and Stephens-Adamson Manufacturing Co. The Traylor Vibrator Co.'s Chicago branch office is located at 222 W. Adams St.

**Keystone Driller Co.**, Beaver Falls, Penn., announces J. Vale Downie has resigned as advertising manager, effective July 1, and that the company's advertising will be handled by the Frank Presbrey Co., general advertising agents, New York, N. Y., in charge of Nils Bowland, vice-president, with offices in the Grant Bldg., Pittsburgh, Penn. The company is planning a direct-by-mail advertising campaign on the new Keystone 1-yd. full revolving shovel and crane.

## Trade Literature

*NOTICE—Any publication mentioned under this heading will be sent free unless otherwise noted, to readers, on request to the firm issuing the publication. When writing for any of the items kindly mention* ROCK PRODUCTS.

**Dryers and Feeders.** Folder gives operating costs of Ruggles-Coles dryers and describes Hardinge constant weight feeder. HARDINGE CO., INC., York, Penn.

**Abrasion of Metals.** "Relative Wear of Metals Due to Abrasion," a paper presented by C. R. Weiss to the American Society of Mechanical Engineers, has been reprinted. LINK-BELT CO., Chicago, Ill.

# Classified Directory of Advertisers in this Issue of Rock Products

*For alphabetical index, see page 64*

*This classified directory of advertisers in this issue is published as an aid to the reader. Every care is taken to make it accurate, but ROCK PRODUCTS assumes no responsibility for errors or omissions. The publishers will appreciate receiving notice of omissions or errors, or suggestions*

**Agitators, Thickeners and Slurry Mixers**
Hardinge Co., Inc.
F. L. Smidth & Co.

**Air Compressors**
Fuller Company
Nordberg Mfg. Co.

**Air Filters**
Fuller Company

**Air Separators**
Hardinge Co., Inc.
Kent Mill Co.
Raymond Bros. Impact Pulverizer Co.

**Automatic Weighers**
Merrick Scale Mfg. Co.

**Babbitt Metal**
Jos. T. Ryerson & Son, Inc.

**Backfillers**
Bucyrus-Erie Company

**Balls (Tube Mill, etc.)**
F. L. Smidth & Co.

**Belt Fasteners**
Flexible Stel Lacing Co.

**Belt Lacing (Steel)**
Flexible Steel Lacing Co.

**Belting (Elevator and Conveyor)**
Goodyear Tire & Rubber Co., Inc.

**Belting (Multiple V)**
Goodyear Tire & Rubber Co., Inc.

**Bin Gates**
Fuller Company

**Boilers**
Combustion Engineering Corp.

**Breakers (Primary)**
Smith Engineering Works

**Buckets (Dragline and Slackline)**
Bucyrus-Erie Co.

**Buckets (Elevator and Conveyor)**
Hendrick Mfg. Co.
The Jeffrey Mfg. Co.

**Cableways**
American Steel & Wire Co.
General Electric Co.

**Cap Crimpers and Fuse Cutters**
Ensign-Bickford Co.

**Cars (Quarry and Gravel Pit)**
Easton Car & Construction Co.

**Cement Making Machinery**
F. L. Smidth & Co.

**Cement Pumps**
Fuller Company
F. L. Smidth & Co.

**Chain (Dredge and Steam Shovel)**
Bucyrus-Erie Co.
The Jeffrey Mfg. Co.

**Chain Systems (Kiln)**
F. L. Smidth & Co.

**Chute or Launder Lining**
Goodyear Tire & Rubber Co., Inc.

**Coal Pulverizing Equipment**
Hardinge Co., Inc.
Raymond Bros. Impact Pulverizer Co.
F. L. Smidth & Co.

**Compressors**
(See Air Compressors)

**Conveyor Belting (See Belting)**

**Conveyors and Elevators**
Fuller Co.
The Jeffrey Mfg. Co.
Lewistown Fdy. & Mach. Co.
F. L. Smidth & Co.
Smith Engineering Works

**Conveyors (Pneumatic)**
Fuller Company

**Coolers (See Kilns and Coolers, Rotary)**

**Correcting Basins**
F. L. Smidth & Co.

**Cranes (Barge)**
The Ohio Locomotive Crane Co.

**Cranes (Clamshell)**
Bucyrus-Erie Co.

**Cranes (Crawler and Locomotive)**
Bucyrus-Erie Co.
The Ohio Locomotive Crane Co.
Thew Shovel Co. (Electric, gasoline and steam)

**Crushers (Jaw and Gyratory)**
Lewistown Fdry. & Mach. Co.
Nordberg Mfg. Co.
Smith Engineering Works

**Crushers (Single Roll)**
The Jeffrey Mfg. Co.
McLanahan & Stone Corp.

**Crushing Rolls**
The Jeffrey Mfg. Co.

**Dippers and Teeth (Steam Shovel)**
Bucyrus-Erie Co.
Thew Shovel Co.

**Dipper Teeth**
The Frog, Switch & Mfg. Co.

**Ditchers**
Bucyrus-Erie Co.

**Draglines**
Bucyrus-Erie Co.
Thew Shovel Co.

**Dragline Cableway Excavators**
Bucyrus-Erie Co.

**Dragline Excavators**
Bucyrus-Erie Co.
Thew Shovel Co. (Electric, gasoline and steam)

**Dragline Excavators (Walking)**
Bucyrus-Monighan Co.

**Dredge Chain (See Chain)**

**Dredges**
Bucyrus-Erie Co.

**Drives (See Gears, Chain Drives, etc.)**

**Dryers**
Combustion Engineering Corp.
Ruggles-Coles Div. of Hardinge Co., Inc.

**Dust Conveying Systems**
Fuller Co.

**Electric Mine Hoists**
Nordberg Mfg. Co.

**Electric Power Equipment**
General Electric Co.

**Elevators (See Conveyors and Elevators)**

**Engineers**
F. L. Smidth & Co.

**Engines (Diesel)**
Nordberg Mfg. Co.

**Excavating Machinery (See Shovels, Cranes, Buckets, etc.)**

**Fans**
General Electric Co.

**Fans (Exhaust)**
The Jeffrey Mfg. Co.

**Feeders**
Fuller Co. (Cement and Pulverized Material)
Smith Engineering Works (Plate)

**Filters and Strainers (Gasoline)**
Alemite Corp.

**Furnaces**
Combustion Engineering Corp.

**Fuses (Detonating and Safety)**
Ensign-Bickford Co.

**Fuses (Electrical)**
General Electric Co.

**Gaskets**
Goodyear Tire & Rubber Co., Inc.

**Gates (Bin) (See Bin Gates)**

**Gears (Spur, Helical and Worm)**
The Jeffrey Mfg. Co.

**Gears and Pinions**
General Electric Co.

**Grease**
Alemite Corp.

**Grinding Balls**
The Jeffrey Mfg. Co.

**Grizzlies**
Smith Engineering Works

**Hammer Mills (See Crushers)**

**Hose (Water, Steam, Air Drill, Sand Section)**
Goodyear Tire & Rubber Co., Inc.

**Insulation (Electric)**
General Electric Co.

**Kilns and Coolers (Rotary)**
Hardinge Co., Inc.
F. L. Smidth & Co.

**Kominuters (See Mills)**

**Lamp Guards**
Flexible Steel Lacing Co.

**Lighters—Hot Wire (For Safety Fuse)**
Ensign-Bickford Co.

**Lime Handling Equipment**
Fuller Co.
Raymond Bros. Impact Pulverizer Co.

**Linings (Iron for Ball and Tube Mills) (See Mill Liners)**

**Loaders and Unloaders**
Bucyrus-Erie Co.

**Locomotive Cranes (See Cranes)**

**Locomotives (Diesel)**
The Fate-Root-Heath Co.
Plymouth Locomotive Works

**Locomotives (Diesel-Electric)**
The Fate-Root-Heath Co.
Plymouth Locomotive Works

**Locomotives (Gas Electric)**
The Fate-Root-Heath Co.
Plymouth Locomotive Works

**Locomotives (Geared)**
Lima Locomotive Works, Inc.

**Locomotives (Oil-Electric)**
The Fate-Root-Heath Co.
Plymouth Locomotive Works

**Locomotives (Steam, Gas and Electric)**
Fate-Root-Heath Co. (Gas)
General Electric Co.
Lima Locomotive Works, Inc.
Plymouth Locomotive Works (Gas)

**Locomotives (Storage Battery)**
General Electric Co.

**Log Washer**
McLanahan & Stone Corp.
Smith Engineering Works

**Lubricants**
Alemite Corp.

**Lubricating Fittings**
Alemite Corp.

**Lubricating Systems**
Alemite Corp.

**Machinery Guards**
Harrington & King Perforating Co.

**Magnets**
General Electric Co.

**Manganese Steel Castings**
The Frog, Switch & Mfg. Co.

**Mills (Grinding) (Ball, Tube, etc.) (See also Crushers, Hammer)**
Hardinge Co., Inc.
Raymond Bros. Impact Pulverizer Co.
F. L. Smidth & Co.

**Mill Liners and Linings (Iron for Ball and Tube Mills)**
F. L. Smidth & Co.

**Molds (Concrete Pipe)**
Universal Concrete Pipe Co.

**Motors and Generators (Electric)**
General Electric Co.

**Oil (Motor)**
Alemite Corp.

**Oils (Graphite)**
Alemite Corp.

**Packings (Pump, Valve, etc.)**
Goodyear Tire & Rubber Co., Inc.

**Perforated Metal**
Cross Engineering Co.
Harrington & King Perforating Co.
Hendrick Mfg. Co.
Morrow Mfg. Co.

**Pipe Machines (Concrete)**
Universal Concrete Pipe Co.

**Portable Conveyors**
Fuller Co.

**Portable Crushing and Screening Unit**
Smith Engineering Works

**Pulverizers (See also Crushers, Mills, etc.)**
Hardinge Co., Inc.
Kent Mill Co.
Raymond Bros. Impact Pulverizer Co.
F. L. Smidth & Co.

**Pumps (Air Lift)**
Fuller Co.

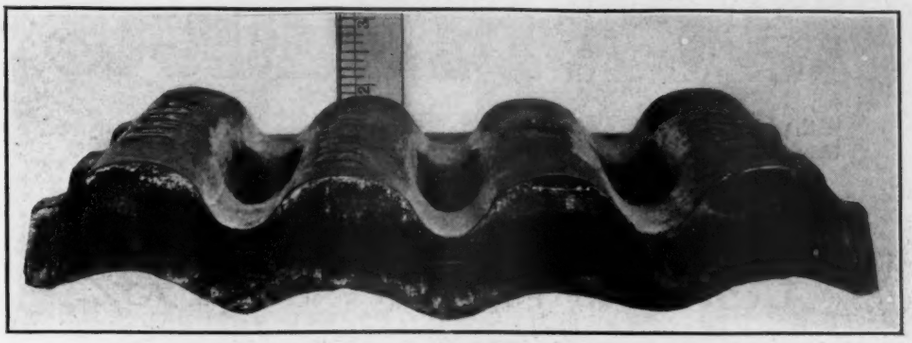
**Pumps (Cement)**
Fuller Company

**Pumps (Cement Slurry)**
F. L. Smidth & Co.

**Pumps (Centrifugal)**
De Laval Steam Turbine Co.

# DRAGPEB LINERS

(Patented)



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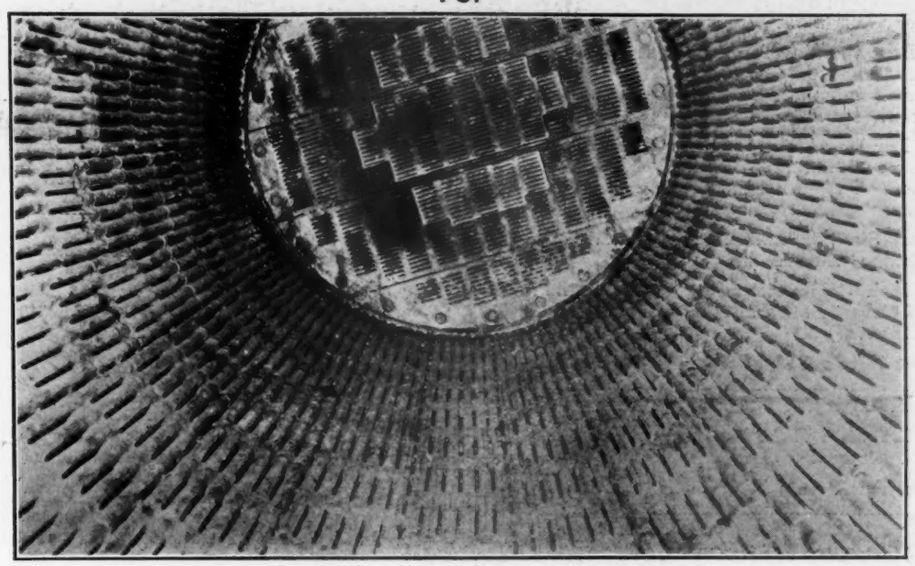

# PULVERIZING MILLS

THE Dragpeb Lining represents a distinct departure from the usual metal lining for wet or dry pulverizing mills of the compartment and tubemill type. The illustration shows why this lining will present practically the same surface and provide the proper tumbling action of the grinding bodies during its entire life.

Cement is used for the installation and no bolts, wedges or special shapes are required.

Dragpeb liners are made of a special mixture of hard iron under rigid laboratory control: the metal in the castings is uniformly hard throughout. The weight is considerably less than for most metal liners, and little metal is discarded when the Dragpeb Lining has outlived its usefulness.

Write for prices and full information

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